

HOUSTON
REGION



SPORTS CAR
CLUB OF
AMERICA

Solo II Course Design *version 3.0*

assembled by Roger H. Johnson
January 1, 1996



Introduction

- Credits
 - This packet is a plagiarism of the experiences of **Karen Babb, Gregg Lee, Jim Garry, Team.Net** and myself, **Roger H. Johnson** (of no sheep...)
- This packet is broken up into 4 categories.
A brief description of each of these categories follows:
 - 1.) Fundamentals** *(pages 3 - 5)*
 - This section contains things to consider about the event site and event procedures before you begin your course design
 - 2.) 10 Basic concepts** *(pages 6 - 58)*
 - Things to consider, techniques and ideas to help you create a course that everyone will like to drive
 - 3.) So you have a blank piece of paper...** *(pages 59 - 79)*
 - How to put your ideas down on paper
 - 4.) Elements, dimensions and real speed** *(pages 80 - 91)*
 - A “real world” view on the relationship of course content to size/horsepower.



Agenda



- **Fundamentals**

- 10 Basic Concepts
- So you have a blank piece of paper...
- Elements, dimensions and real speed
- Summary



Fundamentals

**avoiding all that stuff that can
mess up a perfectly good course**

- Conditions of the surface
 - Avoid sections of the pavement that are breaking up or bumpy
 - Avoid patches or treated areas
 - Beware of fluid spills sticky tar, etc.
 - Avoid drainage grates, manhole covers, or any other non-movable objects
- Course Workers
 - Safe workstation positioning
 - Can they see all of the pylons within their responsibility?
 - Can they get to all of those pylons without delaying the start or causing a red flag?
 - Do they have to cross one part of the course to get to down cones on another part?



Fundamentals (continued)

- Multiple cars
 - If necessary, can two (or more) cars safely be on course at once?
 - Do adjacent section conflicts prevent full use of the time available?
- Start and Finish Lines
 - Have you established clear access to the start and from the finish?
 - Avoid “drag race” starts to ensure a fair start for all competitors
 - Provide a safe finish
 - Don’t point the finish towards nearby spectator areas
 - Allow plenty of room for a safe, non-dramatic shutdown
- Timing and Scoring
 - Can timing crew easily read the car numbers and view the entire course?
 - Is the timing equipment and crew clearly out of harms way? (such as a spinning vehicle)



Agenda

- Fundamentals



- **10 Basic Concepts**

- So you have a blank piece of paper...
- Elements, dimensions and real speed
- Summary



10 Basic Concepts

- 1.) Be a Commercial Artist
- 2.) Use Creativity
- 3.) No Hidden Agendas
- 4.) Be Familiar with the Solo II Course Design Rules
- 5.) Make the Course Flow
- 6.) Use Elements that Favor Horsepower **and** Elements that Favor Handling
- 7.) Use Pointers and Directionals Correctly and Sparingly
- 8.) Line the Course, when possible
- 9.) Place Gates to Avoid Visual Confusion
- 10.) Walk/Drive Your Course with the Intent of Improvement



10 Basic Concepts

1.) Be a Commercial Artist

- As a course designer, you will become an artist. According to Webster, an artist is “one who professes and practices an imaginative art”. Believe me, imagination is required to create a course that is interesting and fun to drive - and when the course design is completed, you will feel like you have created a piece of art!
 - A **Fine Artist** is:
 - An artist whose main goal is to please themselves, and then everyone else can like it or ‘stuff it’
 - A **Commercial Artist** is:
 - An artist whose main goal is to please the customer, while pleasing themselves as well.
- Be a **Commercial Artist** - not a Fine Artist



10 Basic Concepts - Be a Commercial Artist

How does a Commercial Artist Please the Customer?

- Keep in mind, the main goal of course design is to provide the competitors with **Fair, Fun and Safe Competition.**
- After creating a course design, take copies of it to be reviewed and critiqued by your peers (never destroy the original).
 - Leave your pride at home!
 - Listen and hear to what they have to say
 - Ask them to explain the 'hows and whys' of their suggestion
 - Mark your map up with their suggestions and comments
- After the peer review, look over and analyze their comments, and then implement any that you feel improve your course design.
 - Be true to your basic concept - put your own style into their suggestion if you wish. That is the reason you ask to understand the 'hows and whys'.
 - Remember: The great thing about advice is that you don't have to take it - and you might actually learn or see something you had not thought about.



10 Basic Concepts - Be a Commercial Artist

Judging your Success

(If you're yelling at me, should I assume you didn't like it?)

- Ask the competitors about your course directly and listen to what they have to say.
 - What did they like/dislike and why?
 - Know why, so that you can create/avoid that effect again
 - Listen to their comments so that you don't become a Fine Artist, who is usually more concerned with their pride than creating a course that everyone likes to drive.
 - If a favorite element is criticized every time that you use it, it most likely is a poor element; re-think it. Don't force your fellow competitors to accept a particular element just because it is an "old favorite" of yours
 - This may be a little rude, but also try to 'eaves drop' for comments about the course. This is a good way to get their "true" feelings on the matter since they are not concerned with the embarrassment of offending you
 - Don't get discouraged if some people do not like the course. I don't think I have ever designed a course that everybody likes. You can usually tell from the 'why' of their comments as to whether they are whining or have a valid point. Those who won will usually say that they liked it; those that didn't won't...



10 Basic Concepts - Be a Commercial Artist

Judging your success (continued)

- Did you receive unsolicited praise or complaints?
- Note the number of delays for course workers, course repair, etc.
- Track the number of DNF's for other than mechanical failure
 - The goal is zero:
 - acceptable is 1 in 20 on the first run, 1 in 100 there after
- Number and frequency of pylons hit
 - The goal is zero
 - Acceptable is 1 car in 10 hitting any; no more than 3 for any one car
- Keep in mind, the main goal of course design is to provide the Solo II competitors with **Fair, Fun and Safe Competition.**



10 Basic Concepts

2.) Use Creativity

- Creativity is what makes a course interesting to drive.
 - What is creativity in course design?
 - Setting usual maneuvers in a visually different manner
 - Including a variety and number of different types of turns and transients and a sufficient input density
 - Taking a usual maneuver and changing to make it more interesting - not to make it painful!
 - Placing enough challenge into a course without making it “painful”
 - Utilizing the “punish/reward” or “sacrifice/gain” concept
 - Creating situations where the driver must analyze the course carefully to find the fast line(s) - so that those with the right amount of skill, aggression, experience and discipline will be rewarded
 - Use the chalk lines in variety of helpful ways
- Be creative and innovative but avoid the bizarre
 - When you come up with a concept that you believe to be new and creative, take a moment to analyze it. Is it so creative that it has become bizarre? If so, modify the idea or forget it, because it will not be well received by most drivers



10 Basic Concepts - Use Creativity

Application of Creativity

- Include turns of varying radii and speed
 - Sweepers should come in various sizes, possibly even with changing radii
 - Don't design a course consisting primarily of 180° turns.
 - use 90°, 180°, 60°, fast 45° turns, etc.
- Provide a variety of car path directions
 - Use the various turns to send the car in directions not always perpendicular or parallel to the outside perimeter of the course
- Provide a variety of transients
 - Straight slaloms / offset slaloms
 - Sequences of offset gates
 - Lane changes
 - Combinations of the above
 - Challenging courses include combinations of transients that require a precise proper entry into the first part of the combination in order to drive through the entire combination quickly



10 Basic Concepts - Use Creativity

Application of Creativity (continued)

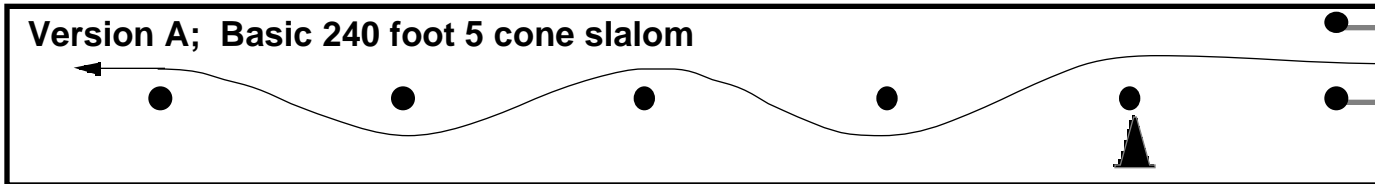
- Provide sufficient input density
 - **Input density** is a measure of direction-changing inputs which the driver must give to the car to negotiate the course divided by the length of the course
 - A good course has 30 to 40 inputs over a distance of approximately 3/4 mile
 - A less interesting course will have only 15 to 20 inputs for the same distance
 - If input density is over 50 inputs for 3/4 mile, odds are that the design is too busy
- Results of too great an input density
 - Drivers will never seem to have the time or room to set up for the next element
 - Drivers feel they are thrashing through the course, just trying to survive until the finish
- Results of too little input density
 - A boring, non-challenging course to drive



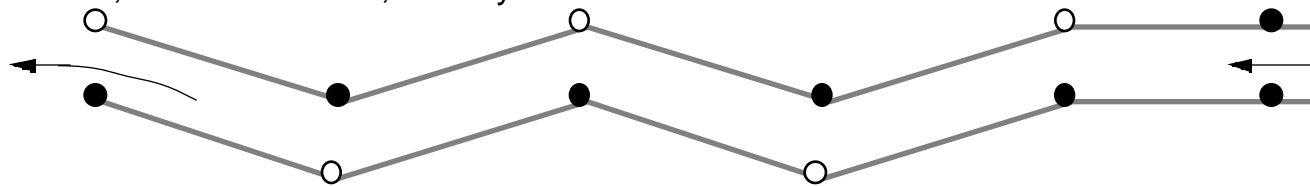
10 Basic Concepts - Use Creativity

5 Cone Slalom

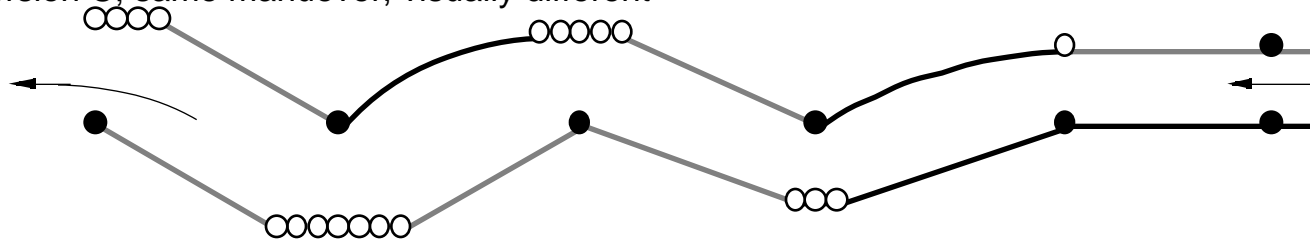
Version A; Basic 240 foot 5 cone slalom



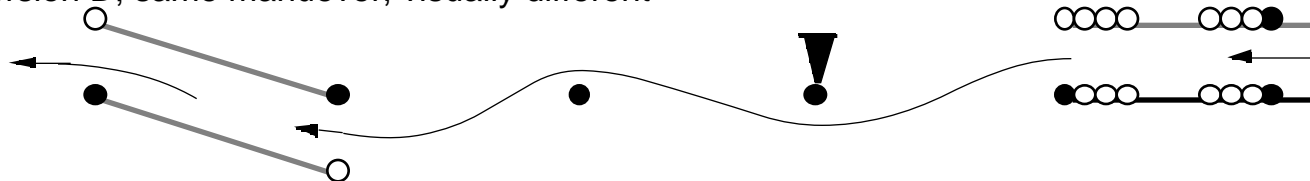
Version B; same maneuver, visually different



Version C; same maneuver, visually different



Version D; same maneuver, visually different

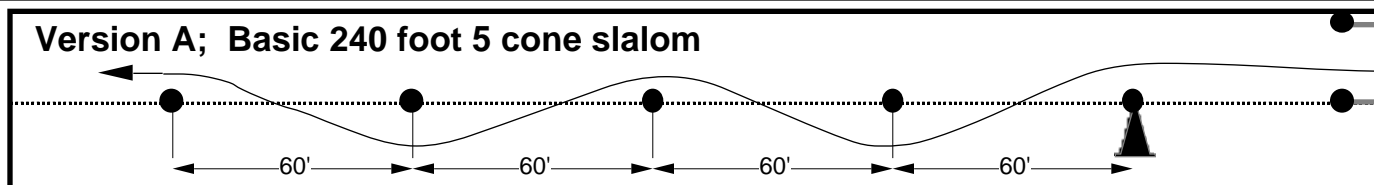




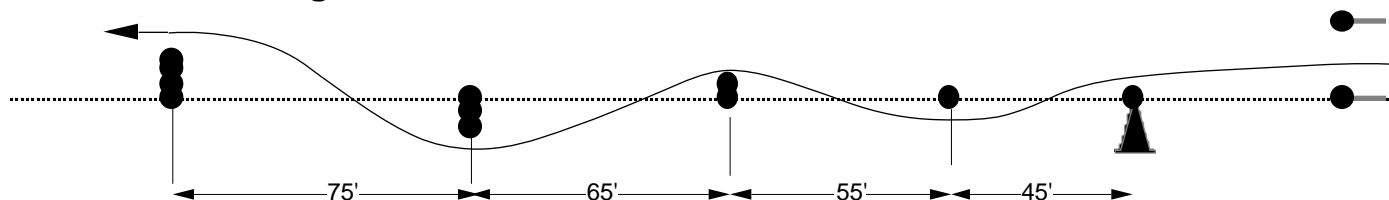
10 Basic Concepts - Use Creativity

5 Cone Slalom (continued)

Version A; Basic 240 foot 5 cone slalom

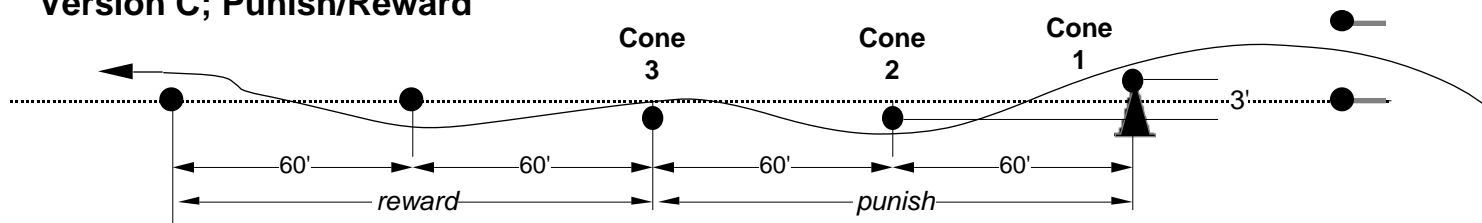


Version B; Change for interest



Note: Version A & B are both 240' long. Version B offsets one cone width for each gain of 10' in slalom length, resulting in a more interesting maneuver of the same nature. The increase in distance prevents the maneuver from becoming painful.

Version C; Punish/Reward



Note: Cones 1 & 2 are offset 3' the hard way with cone 3 offset 1.5' the easy way. This opens up a "Lotus freeway" through the last 3 cones of the slalom. To make the punishment bearable, be sure to allow adequate set up area prior to the punishment, otherwise the punishment becomes painful.

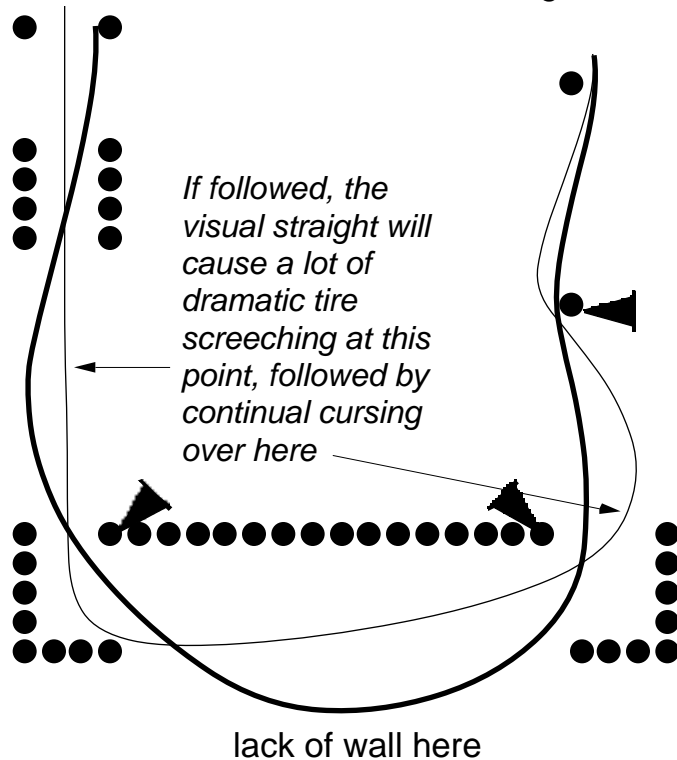


10 Basic Concepts - Use Creativity

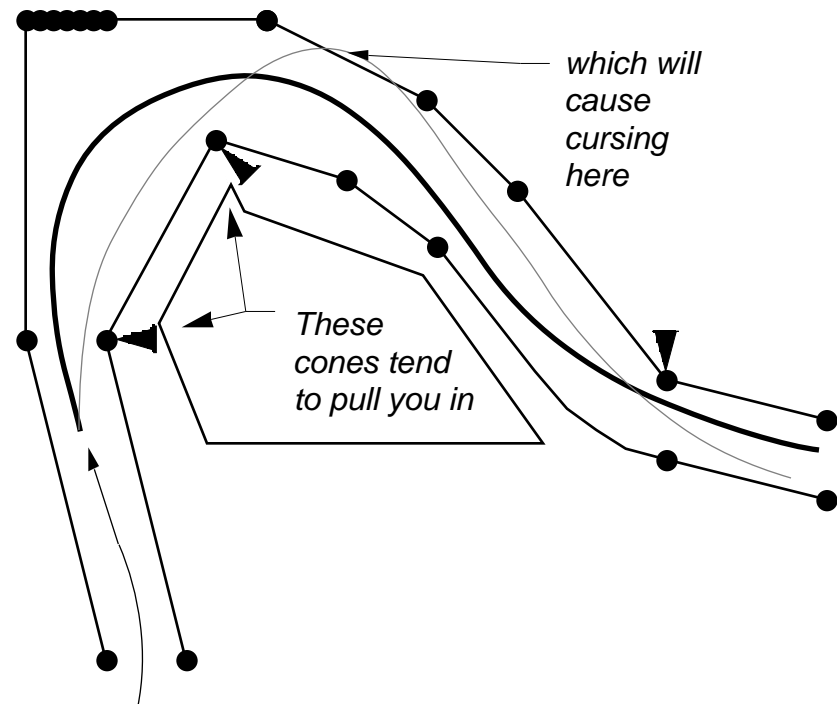
The Brainer

the intent of a "brainer" is to allow a fast line through, but give it the visual effect of a slow maneuver. This will then give the competitor a reward, or a "doggy bone" if you prefer, for figuring it out.

The Brainer: The wall at the 180° will tend to make an unwary competitor square the corner out. The driver who looks carefully will round the corner out and use the lack of wall to their advantage



The Brainer: Competitors that don't "read" the course tend to drive cone to cone. The indicated cone will tend to pull in a driver who has not thought this one out. The fast line is to stay wide to make a sweeping turn.



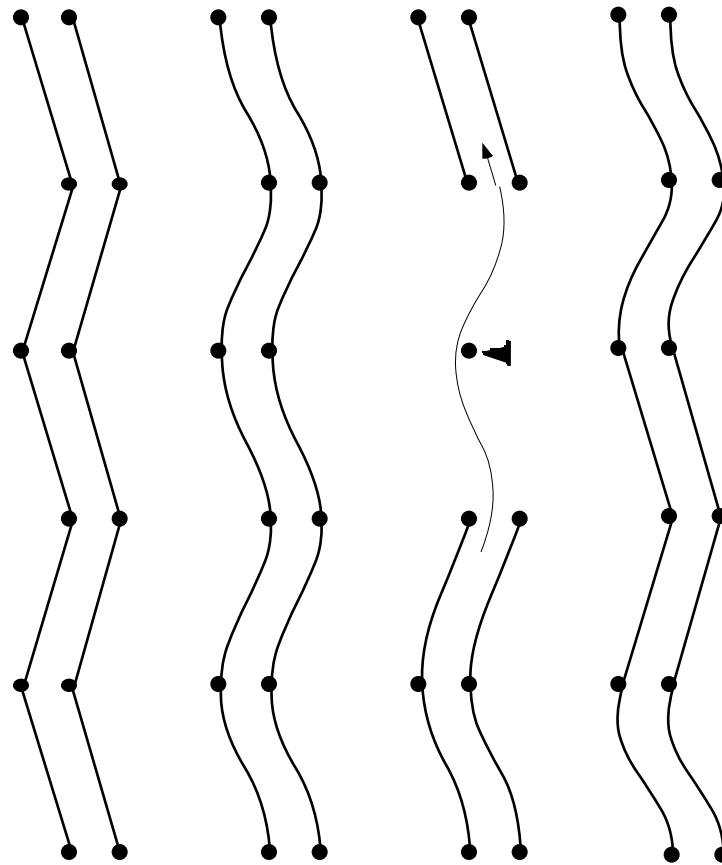
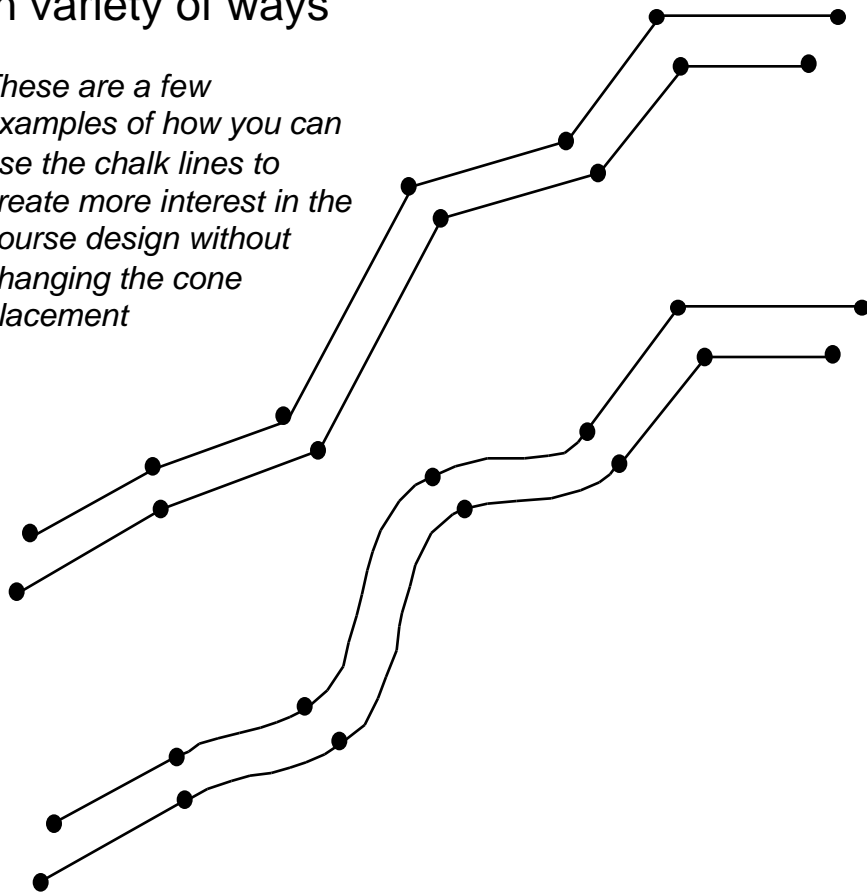


10 Basic Concepts - Use Creativity

Chalk Lines

Use the chalk lines
in variety of ways

*These are a few
examples of how you can
use the chalk lines to
create more interest in the
course design without
changing the cone
placement*

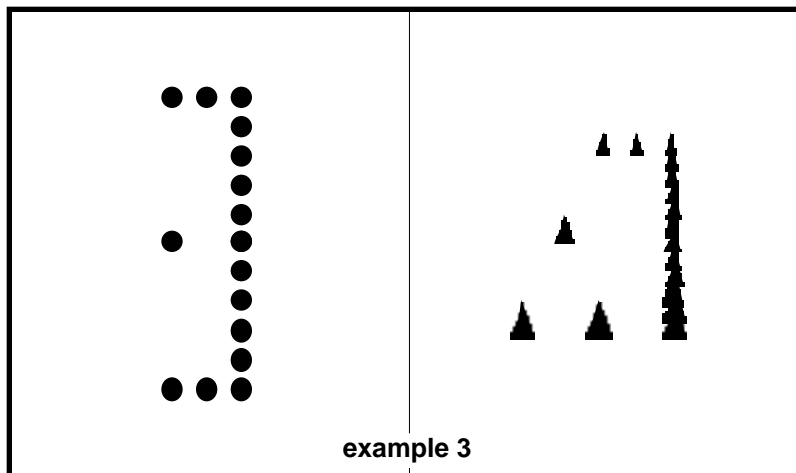
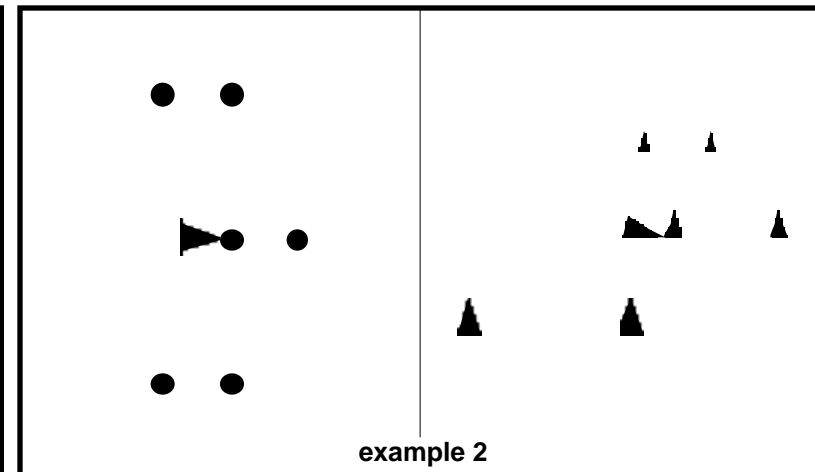
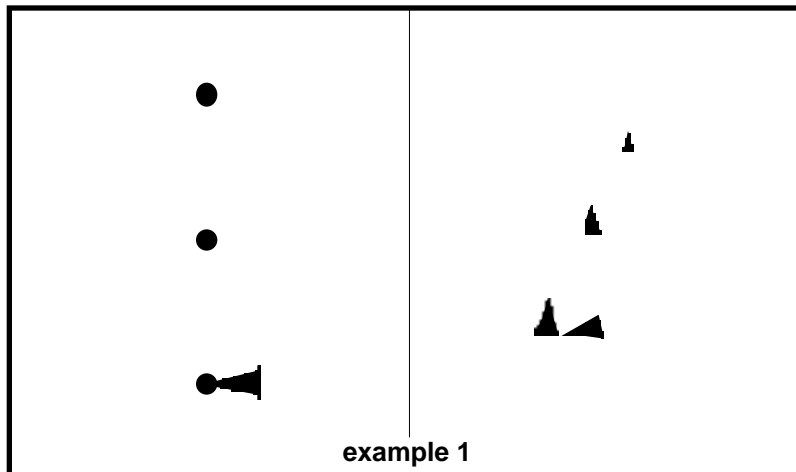




10 Basic Concepts - Use Creativity

Which is easiest to see?

All three of these are the same maneuver. Obviously, example 1.) is easiest to see.



You must also consider if the inclusion of your “creative” cone placement has reduced the clarity of the course significantly.

In this case, the surrounding cones from the following maneuvers may impact the clarity of these examples as well. For instance, if you have several walls of cones just following this slalom, example 1 would be most appropriate. If there were not, example 3 might be appropriate.



10 Basic Concepts

3.) No Hidden Agendas

- You should not accept a course design job for any reason other than a desire to design a course.
 - If you are not really interested in the design of it, chances are that you will not create a good course
 - If you have gotten the responsibility 'by default' (i.e the responsibility comes with being Event Chairman), try to enlist someone who is truly interested in designing a course. You will still be ultimately responsible for the design, but will have "jobbed" it out to a more qualified/interested party.
 - Avoid designing the course on the premise of favoring your car while penalizing others
 - Example; Vette versus Miata:
 - 1000' straight, 180° turn, and 1000' straight
 - Ten 45' offset slaloms, with the remainder of the course filled in by 30' radius "sweepers"
- With a hidden agenda the result will be a course that only a few people enjoy - or perhaps even a course that **NO ONE** will enjoy!



10 Basic Concepts

4.) Be Familiar with the Solo II Course Design Rules

Basic Concept 4.) deals with the Solo II Course Design Rules found in Section 2.0 of your Solo II rule book.

- The obvious advantage to knowing the rules in Section 2.0 is that you will be more likely to create a design that will be considered a Solo II type course, as well as a course that is acceptable to the assigned Safety Stewards and your competing peers
- The following are some quotes from those rules. ALL of the rules, of course, are important and should be known/understood. These are just the rules that I perceive to have the most impact on your design decisions.
 - 2.0 Solo II courses should be open enough to allow good competition between larger and smaller cars and should not emphasize high speed, power to weight ratio, extreme maneuverability or visual acuity...
 - 2.1.A ...speeds on straight stretches should not normally exceed 70 mph for the fastest cars. The fastest portions of the course shall be those most remote from the spectators and property. Turns should not normally allow speeds in excess of 45 mph in unprepared cars



10 Basic Concepts - Solo II Course Design Rules Familiarity

Thus Quoth the Rule Book...

- The following are some quotes... (continued)
 - 2.1.C The course boundary shall not normally pass closer than 25 feet from solid objects.
(see diagram on page 24)
 - 2.1.L Spectators must be kept at a safe distance...
...minimum distances may not be less than 75' from the course edge in unprotected areas (areas without adequate barrier protection such as concrete or tire walls).
(see diagram on page 25)
 - 2.1.D Negative cambered turns will be avoided if at all possible.
(see diagram on page 26)
 - 2.1.E A long straight (over 150') should not terminate in an extremely sharp turn...
(see diagram on page 27)
 - 2.1.G Cars on course simultaneously shall not run in close proximity to each other.
(see diagram on page 28)



10 Basic Concepts - Solo II Course Design Rules Familiarity

Thus Quoth the Rule Book Some More...

- The following are some quotes... (continued)
 - 2.1.J Entrance and exit lanes shall enter the course at separate points, though they may be close together.
 - 2.2.B The course shall be at least 15 feet wide and single file slalom markers shall be at least 45 feet apart. Any series of course markers which are generally in a line and have the effect of a slalom are considered to be a slalom...
(see page 15, *"Examples of Creativity"*; Basic 5 cone slalom)
 - 2.2.E Cars should leave a gate/turn headed generally in the direction of the next gate/turn
(see diagram on page 39)



10 Basic Concepts - Solo II Course Design Rules Familiarity

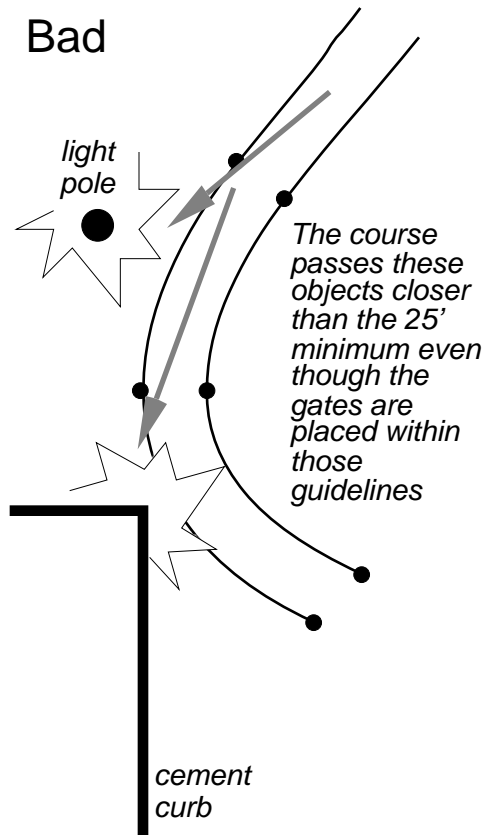
2.0 Diagrams

2.1.C

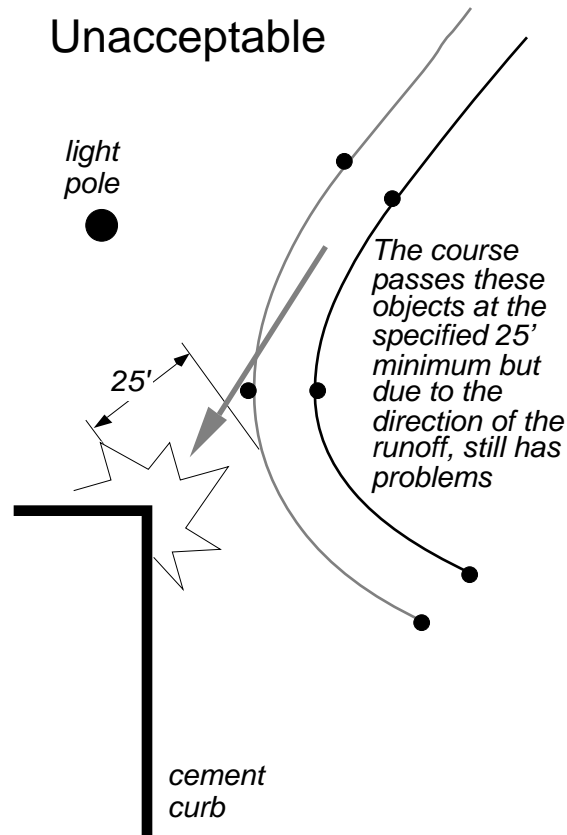
The course boundary shall not normally pass closer than 25 feet from solid objects

The preferred example shown here is considered minimum. Greater distance from stationary objects is always better

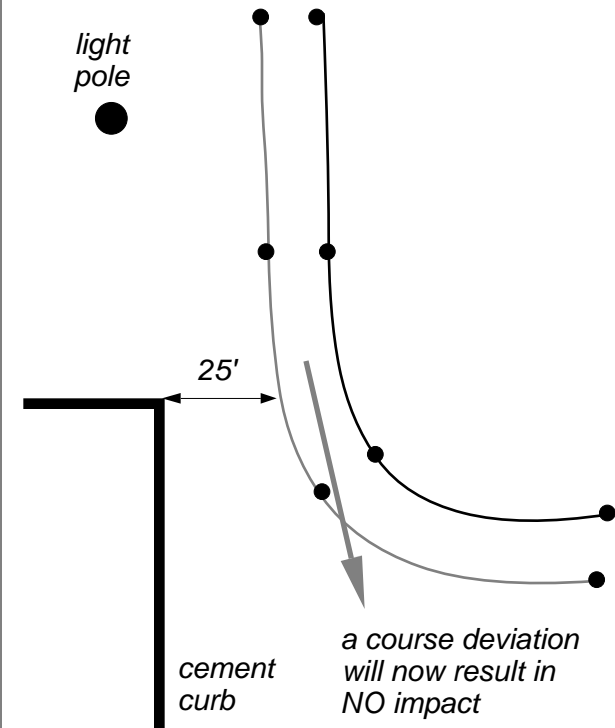
Bad



Unacceptable



Better





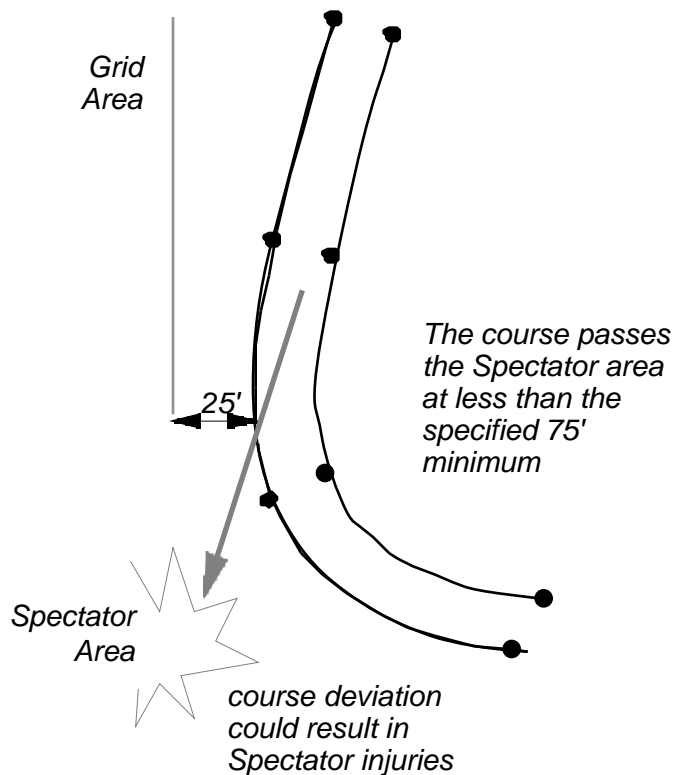
10 Basic Concepts - Solo II Course Design Rules Familiarity

2.0 Diagrams (continued)

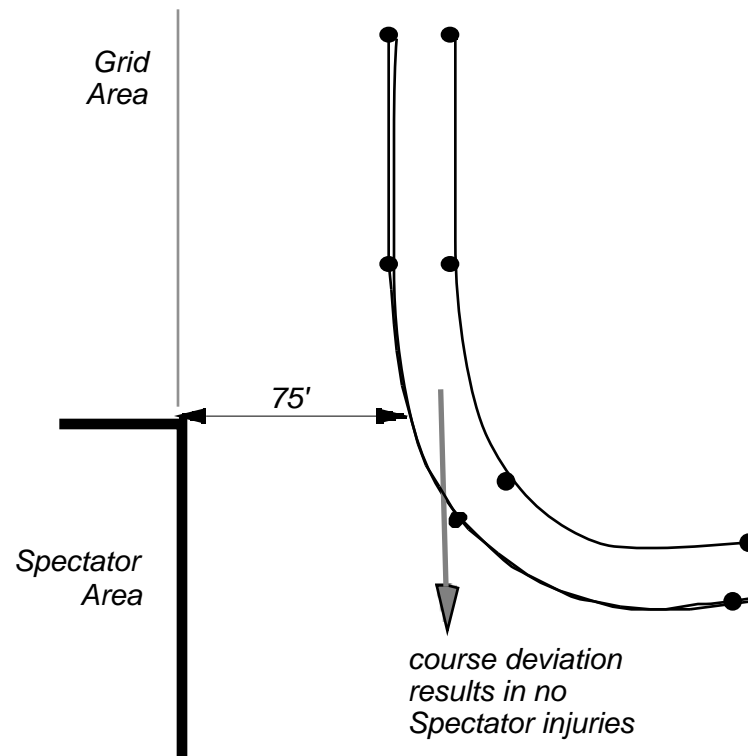
2.1.L

The preferred example shown here is considered minimum. Greater distances from Spectator Areas are always better. Fast course sections should never aim directly at spectator areas without very large runoff distances

Incorrect



O.K.





10 Basic Concepts - Solo II Course Design Rules Familiarity

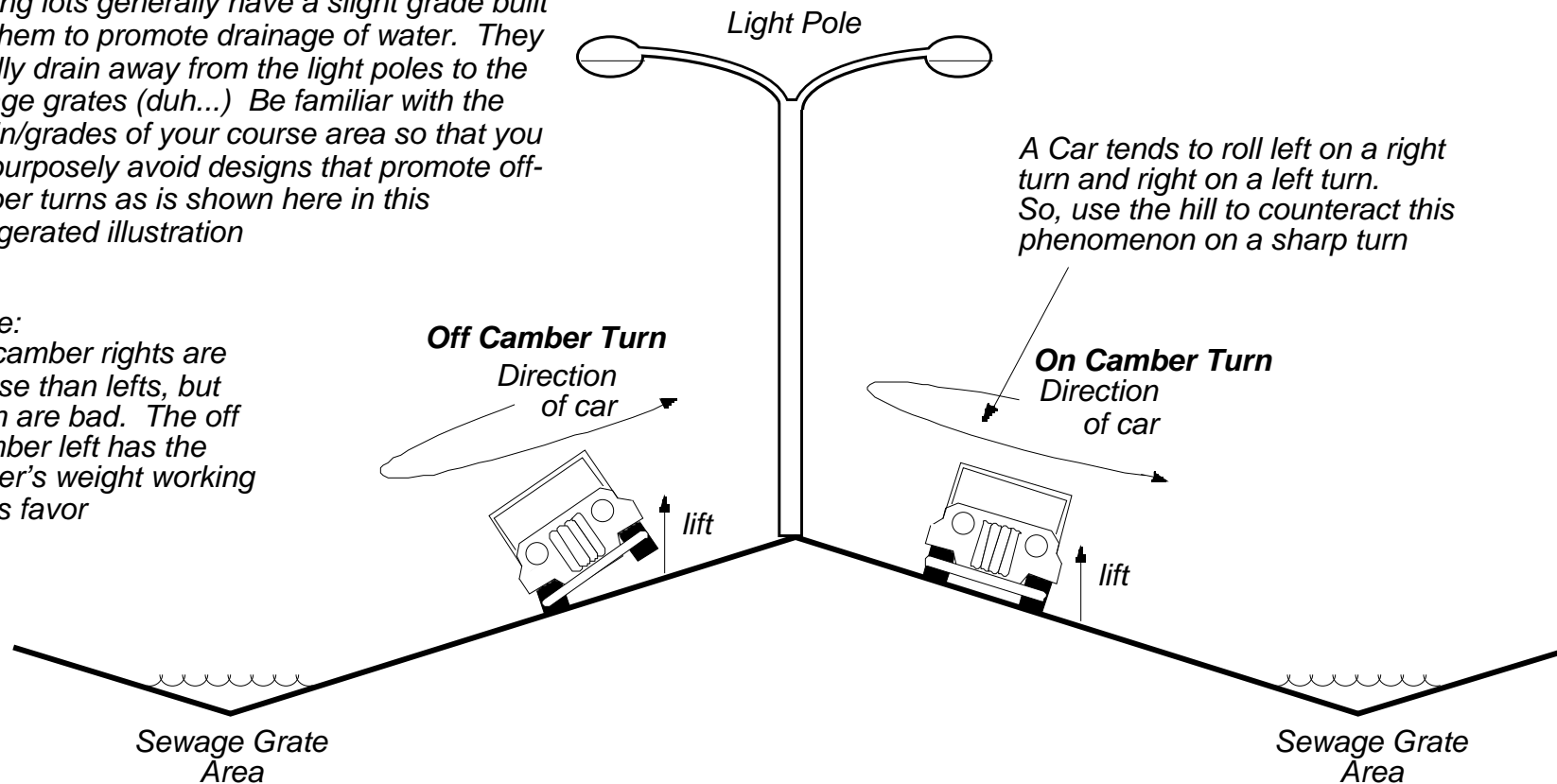
2.0 Diagrams (continued)

2.1.D

Sharp or fast negative cambered turns will be avoided if at all possible.

Parking lots generally have a slight grade built into them to promote drainage of water. They usually drain away from the light poles to the sewage grates (duh...) Be familiar with the terrain/grades of your course area so that you can purposely avoid designs that promote off-camber turns as is shown here in this exaggerated illustration

*Note:
off camber rights are worse than lefts, but both are bad. The off camber left has the driver's weight working in its favor*



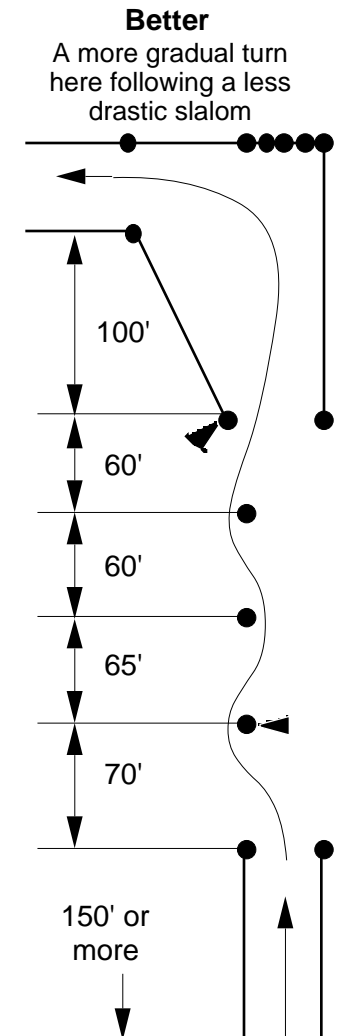
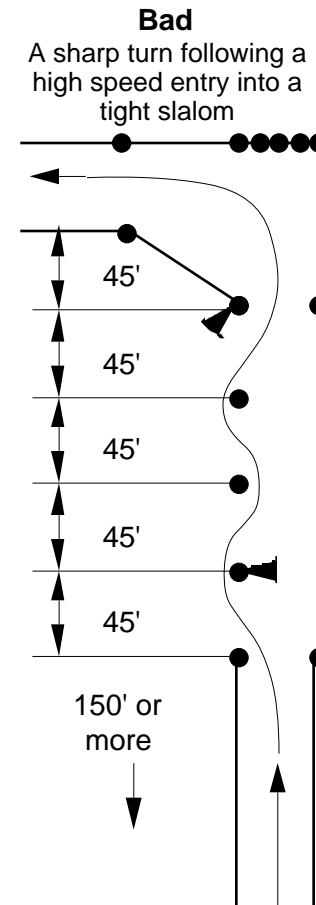
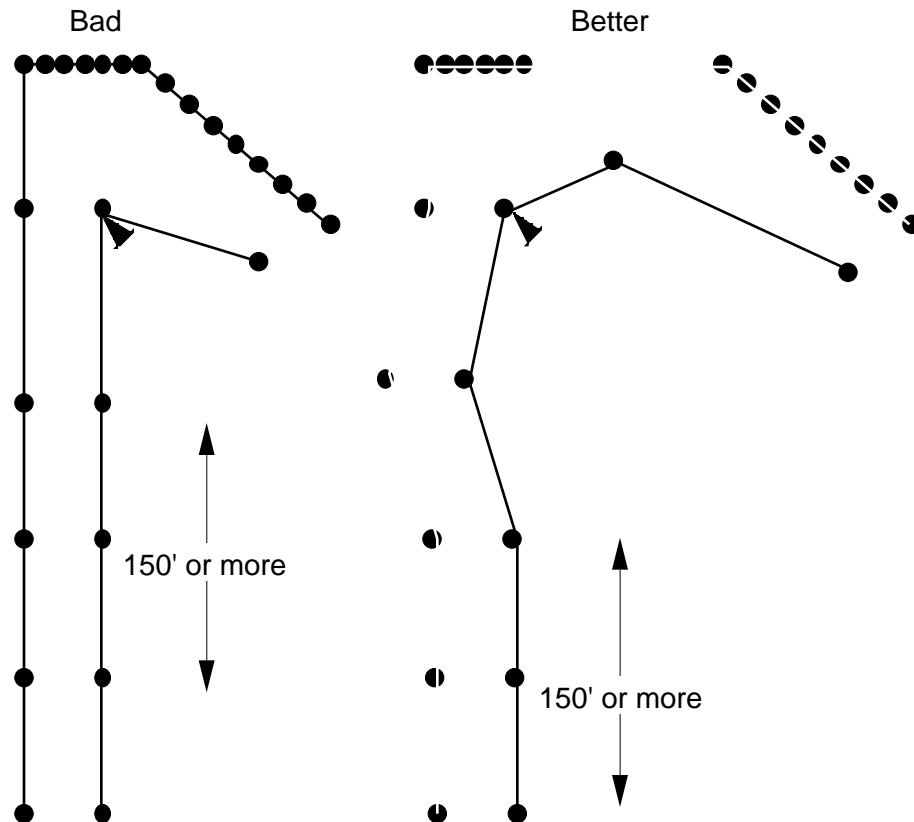


10 Basic Concepts - Solo II Course Design Rules Familiarity

2.0 Diagrams (continued)

2.1.E

A long straight (over 150') should not terminate in an extremely sharp turn...





10 Basic Concepts - Solo II Course Design Rules Familiarity

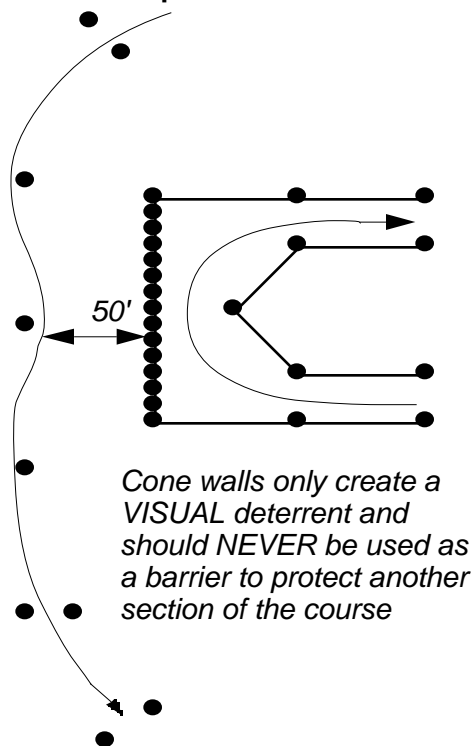
2.0 Diagrams (continued)

2.1.G

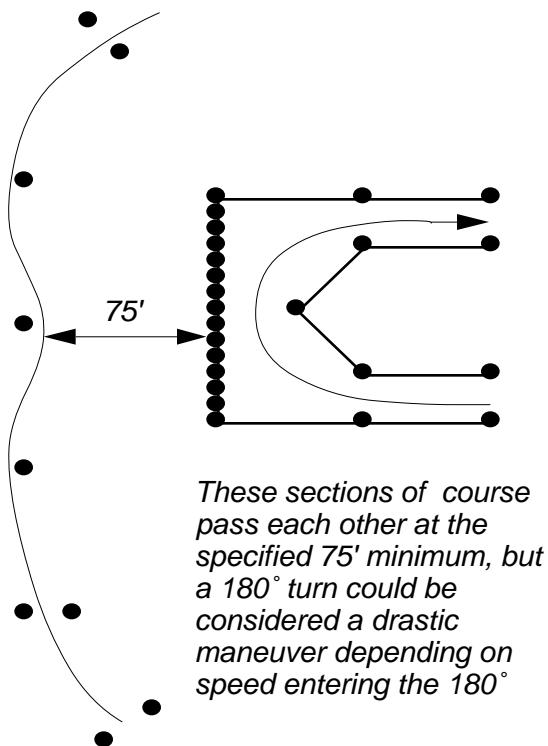
Cars on course simultaneously shall not run in a close proximity to each other

"Close Proximity"... The definition of this is ultimately up to the Safety Steward, but if you consider rule 2.1.L, the absolute minimum would be 75'. Obviously, the more drastic the maneuver, the more space that should be allotted. The whole idea of this rule is to keep 2 competitors from colliding in the event of one (or both) of them losing control or getting lost on course.

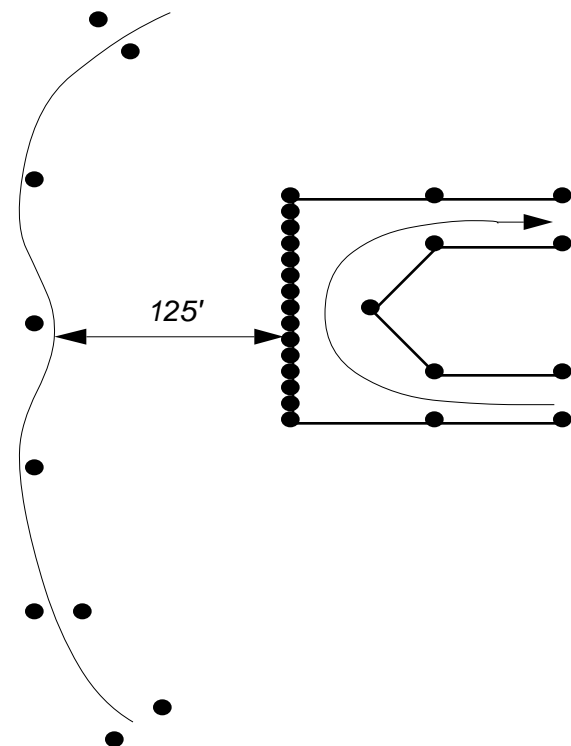
Unacceptable



Better



Better Yet





10 Basic Concepts

5.) Make the Course Flow

“There’s no such thing as a car that can turn on a dime...” K. C. Babb

- It’s not necessary to get into third gear in order to have a fun course. The level of “fun” will more likely be determined by the flow of the course instead of the highest attained speed.
- So, then what is the “Flow of the Course”?
 - The flow generally refers to the manner adjacent sections of a course connect to each other.
 - Envision a river flowing down a riverbed. Even when the water is moving rapidly and encounters an object, it will find a way to flow around the object smoothly. Your course should have the same characteristics. If a car cannot be maneuvered through the obstacles smoothly, the course does not flow.



10 Basic Concepts - Make the Course Flow

Ways to Make Your Course Flow

- Visit the site before submittal of your map to make your map accurate and to include things and land formations to avoid
- To be able to accurately determine the flow of a course before you set it up, you must be able to first **draw a scale map** (gasp!). From this map, you will then be able to apply the following suggestions on paper.
- Locate the “key cones” in your design (*see page 32*)
 - These are the cones that determine the actual path of the car
 - If it **is** a key cone, its removal would change the path of the vehicle running the course.
 - If it **is not** a key cone, the removal of that cone would not change the path of the vehicle, but could confuse the driver...
 - There is a common misconception that the wider the gate, the faster the course. This is not necessarily so. Since the key cones determine the path of the vehicle, the gate width becomes a secondary limiting factor. (*see page 33*)
 - Once the key cones have been identified, look to see if varying gate width or key cone placement can be used to aid in the flow of the course



10 Basic Concepts - Make the Course Flow

Ways to Make Your Course Flow (continued)

- Determine which cones control the speed of the course and remove all unnecessary cones
(see diagrams on pages 33 and 34)
- Remove a slalom cone in a 45' - 55' slalom (see page 35)
- Allow a few more feet of width and/or length when approaching the next maneuver (see page 36)
- Avoid painful walled-in turns (see page 37)
- Ensure the “next gate” is visible in your peripheral line of sight (see page 38)
- Move a limiting or constricting gate 1 to 10 feet left or right to open the approach up. Be careful; movement as little as 1 foot can make more of a difference than you might imagine. The approach from the previous maneuver and/or the exit to the next maneuver will determine the impact of this move.
- Do not use *painful* maneuvers to slow things down (see pages 39 and 40)
 - A 300' straight into a 45' slalom **IS** painful. Either shorten the straight or lengthen the slalom
 - Allow a minimum of a 30' radius in your turns
 - Allow the driver ample room to choose a favorable line
 - No lock-to-lock turns



10 Basic Concepts - Make the Course Flow

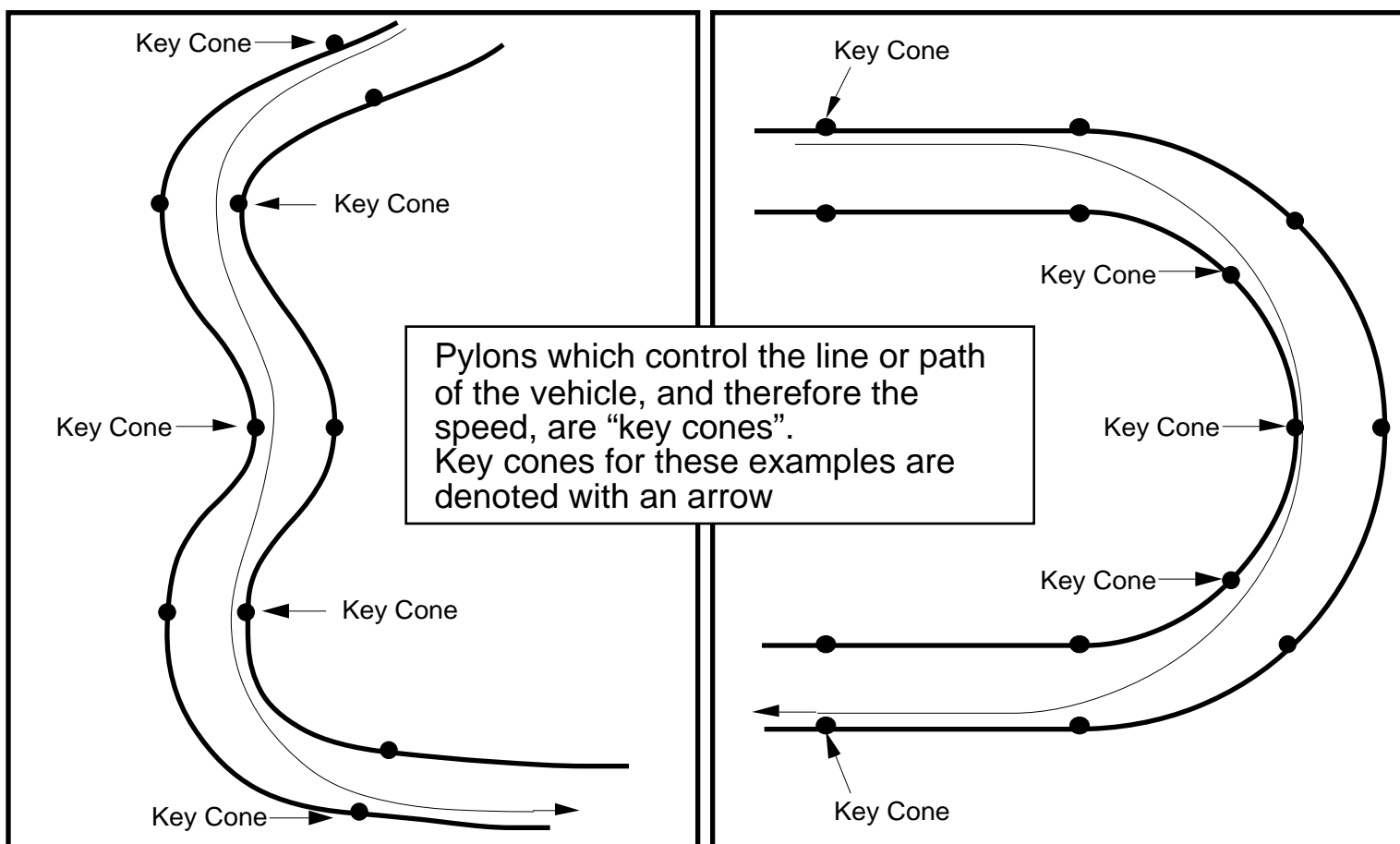
Maneuvers to Avoid

- Avoid maneuvers that could make a car roll (*see page 27*)
 - Don't use significantly off camber turns, especially right turns
 - Don't use decreasing radius right turns - especially sharp ones
 - Avoid "one-two" hard corrections following a fast section as you can find in a decreasing slalom
- There are also a few "No Fun Maneuvers" (NFM) that I would recommend avoiding if possible
 - Any maneuver that requires a 1st gear down shift
 - 360° pivot turns - or also known as a spin cone
 - Narrow, walled in sharp turns
 - Gates with severe offsets and short spacing
 - Offset 45' slaloms
 - Two 90° walled in turns (shaped like a "Z") just before the finish lights (which is O.K. for a start - but no way to finish!)
 - Hitting the brakes hard just before the lights



10 Basic Concepts - Make the Course Flow

Locating Key Cones



Gate Width versus Speed

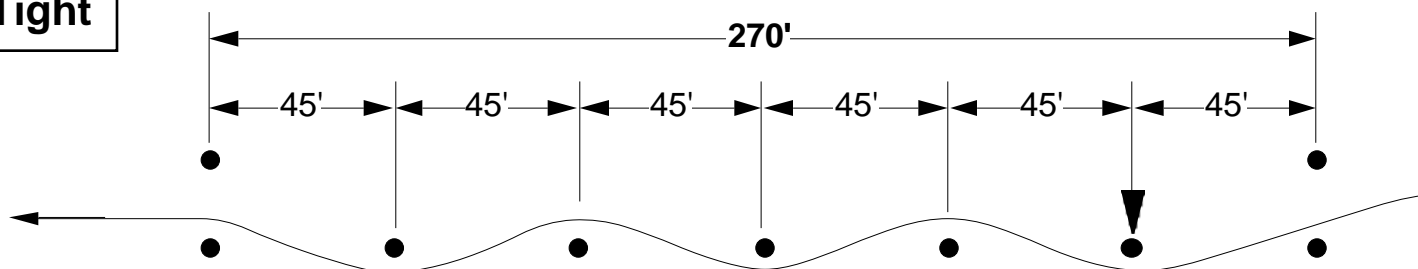
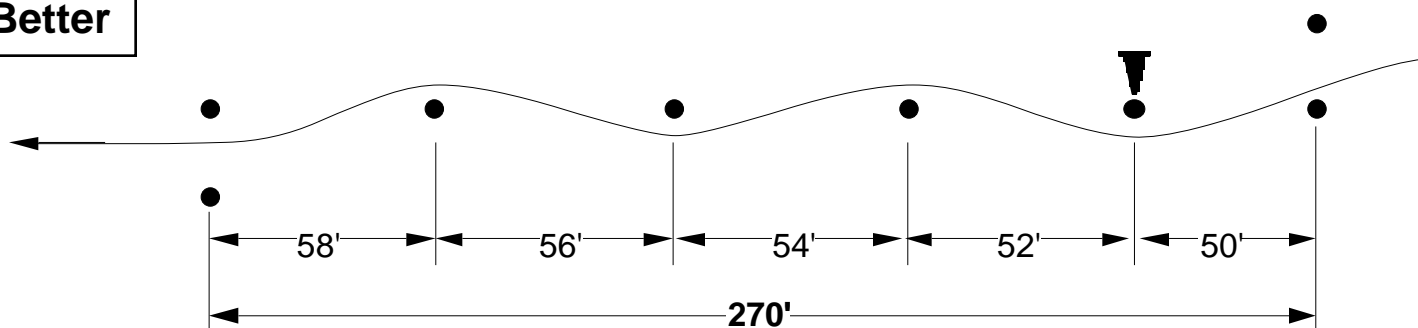


- Choosing the superior line requires more skill and experience
- Allows for mistakes/sloppiness with no pylon penalties
- Easier on course workers and timing & scoring



10 Basic Concepts - Make the Course Flow

Remove a Slalom Cone

Tight**Better**

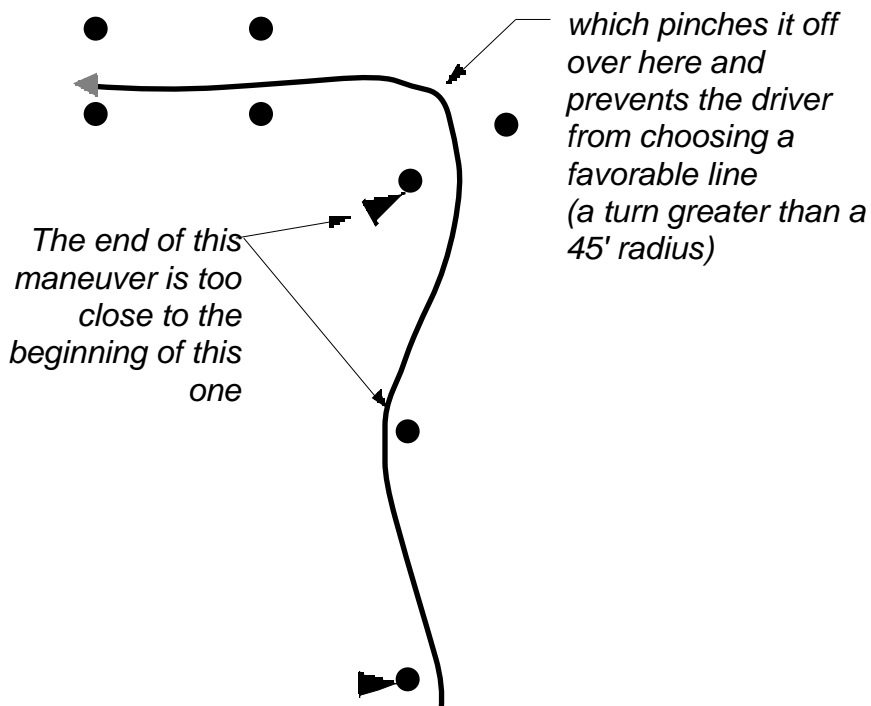
- By removing only one cone in this 270 foot slalom, you are able to open up the slalom to a more reasonable spacing of 54feet. This is not a “wide open” slalom and definitely flows better than the example on top. You can also make the slalom a gradually increasing allowing the more astute course walkers the chance to pick up on a feature that not everyone will realize



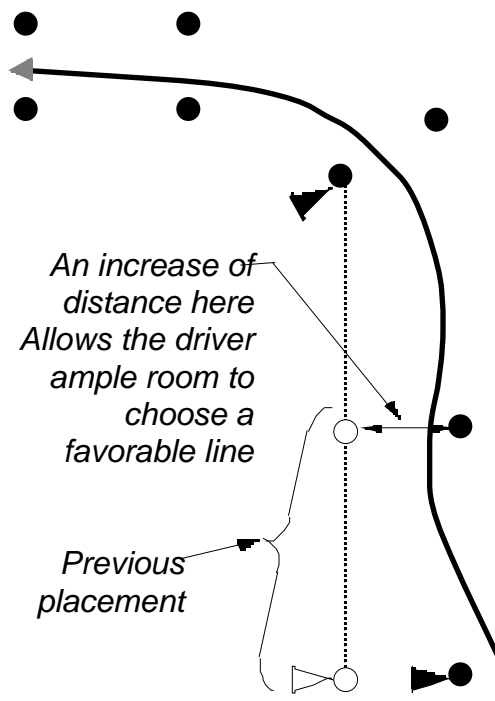
10 Basic Concepts - Make the Course Flow

Allow Room for Set Up

- Allow a minimum of a 45' radius in your turns
- Allow the driver ample room to choose a favorable line



Below is an example of what I believe to be a better solution with the same "flavor" as the original idea



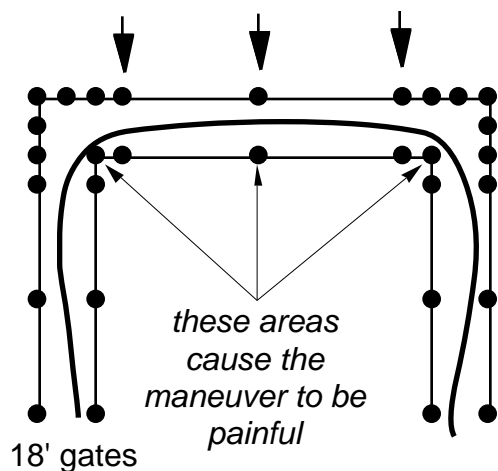
Note: There are usually a variety of ways to accomplish this effect. In this case, moving the last 2 gates farther up and leaving the slalom where it was placed originally would have worked as well.



10 Basic Concepts - Make the Course Flow

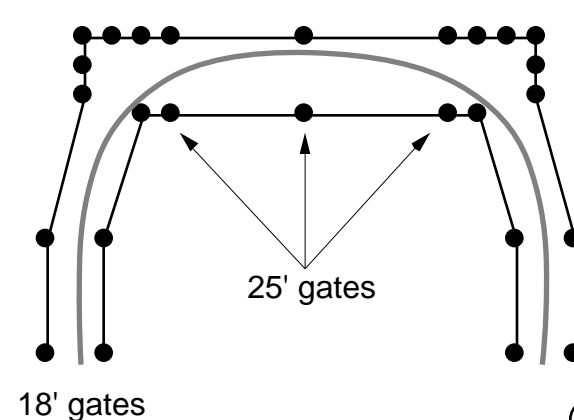
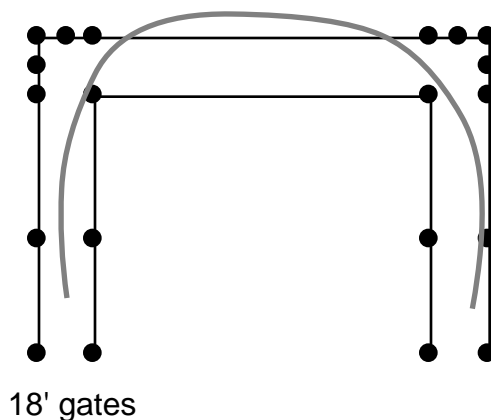
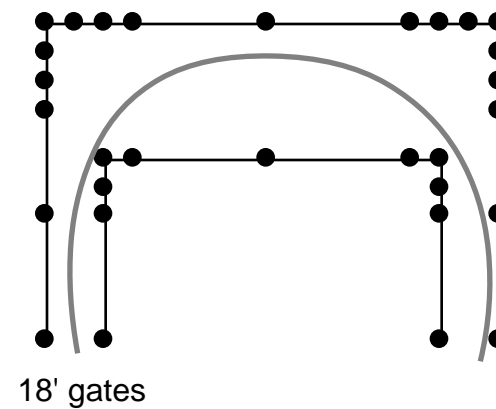
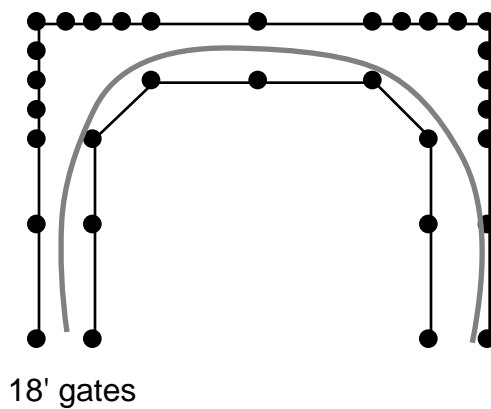
Avoid "Painful" Walled in Turns

• Narrow, walled in sharp turns



The problem associated with narrow walled in turns is that the placement of the wall forces the turn to be made up of 2 or more sharp turns instead of a sweeping turn

Examples of better solutions with the same flavor as the original



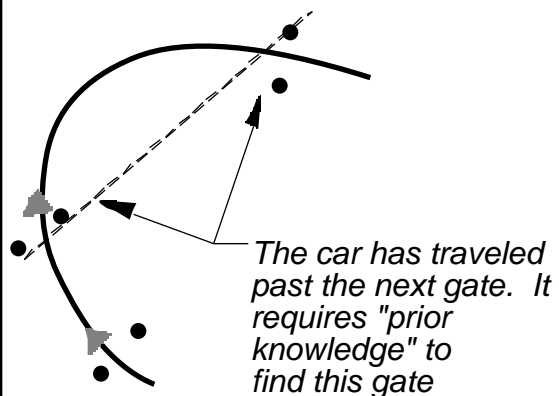


10 Basic Concepts - Make the Course Flow

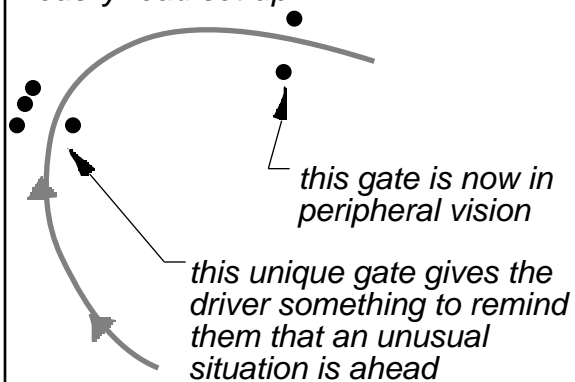
Line of Sight and 90° Turns

- **Ensure the next gate is visible in your line of sight**

please refer to Solo II rule 2.2.E

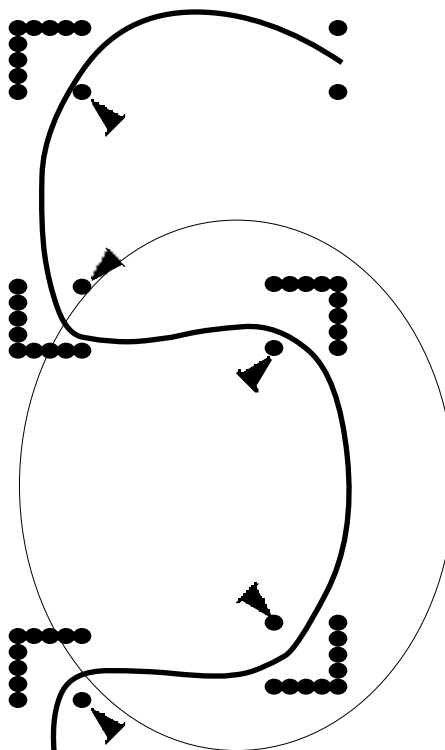


Below, is the same turn with a more easily read set-up

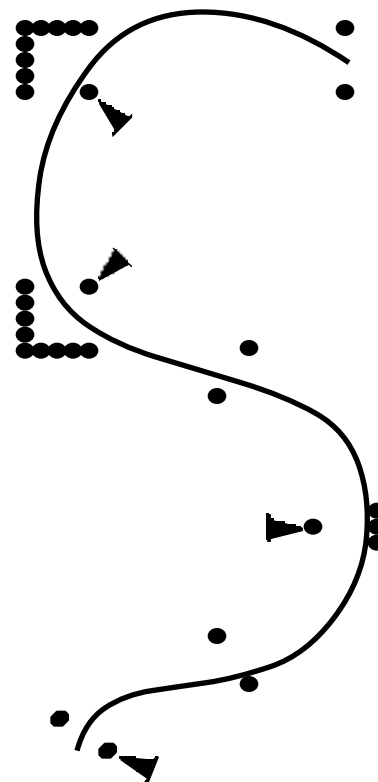


- **Improper use of 90° turns will quickly inhibit the flow of the course**

This course loses its flow in the circled area



The same basic car path can be retained by placing the gates in this manner without losing the flow

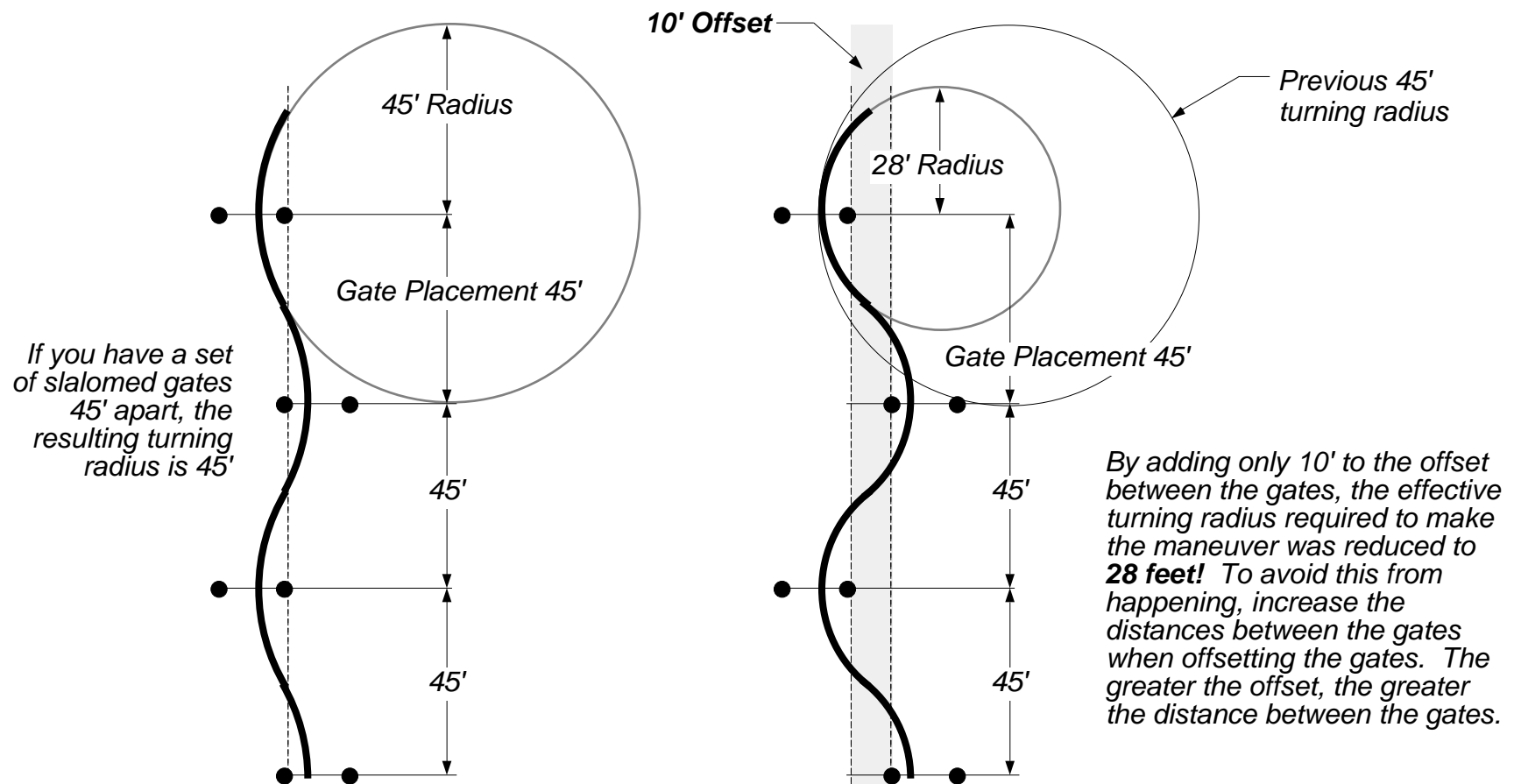




10 Basic Concepts - Make the Course Flow

Lock to Lock Turns

- No lock to lock turns

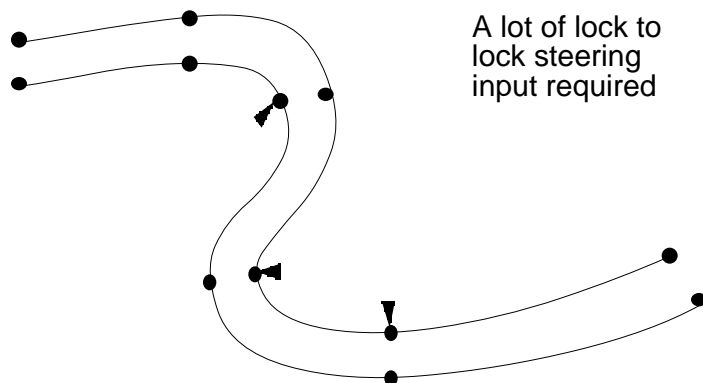




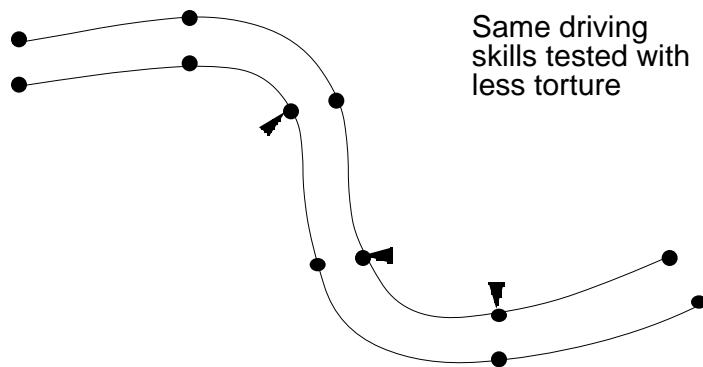
10 Basic Concepts - Make the Course Flow

Lock to Lock Turns (continued)

not fun

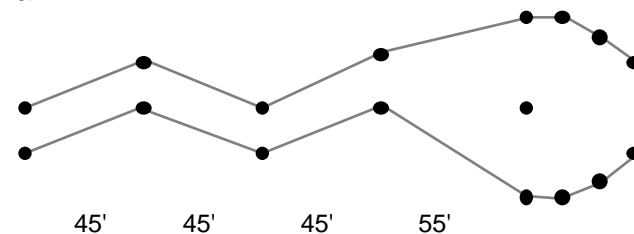


better



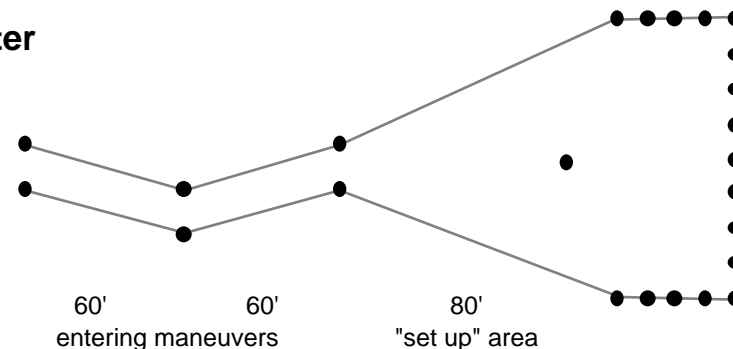
Generally, avoid 180° turns. The shape of some lots require a 180° turn, however, so don't make them painful with lock to lock steering inputs just before entering the 180

painful



- Open up the entering maneuvers
- Allow plenty of setup room to enter a 180° turn. Align your entry/exit gate centered to the 180 cone, unless you have allowed extra of room for your entry/exit of the 180

better





10 Basic Concepts

6.) Use Elements that Favor Horsepower and Elements that Favor Handling

- The reason for using both types of elements is to create an “equalizer” course. This would be one where a Miata would have no advantage over a 944 which are found in the same class. By doing so, you will have a much greater chance of pleasing the majority of the drivers in attendance. Then again, if you are designing a course for the Mustang club...
- The first thing to decide is what favors horsepower and what favors handling. You then can evenly apply those kinds of maneuvers in your design.
- In a over simplified explanation,
 - *Horsepower* is advantageous where a car with a high power/weight ratio can stand on the gas, or any maneuver that requires standing on the gas following completion of the maneuver (such as a sharp turn).
 - *Handling* is advantageous in a situation where a nimble but under-powered car will be able to maintain speed, but a less nimble and more powerful car will not.



10 Basic Concepts - Horsepower and Handling

General Categories of Horsepower and Handling

horsepower

straights (duh...)
large radius sweeping turns
sharp turns (90° or more)
maneuvers connected with straights
open maneuvers
etc.

handling

short spaced slaloms
small radius sweeping turns
chicane/lane changes
successive maneuvers
tight maneuvers
etc.

- Straight:
 - Is any area where full acceleration can be utilized, and is not necessarily the classic definition of the shortest distance between two points. Minimize the “classic” straight lengths utilized on the course and try to use sweepers and increasing slaloms. A slalom spaced greater than 100’ can be considered a straight
- Large radius Sweeping Turns:
 - Any turn over 100’ radius. These turns allow a moderate amount of acceleration and a fairly high limit of speed
- Small radius Sweeping Turn:
 - Any turn ranging between 30’ and 60’ radius. These turns offer minimal acceleration and a fairly low limit of speed



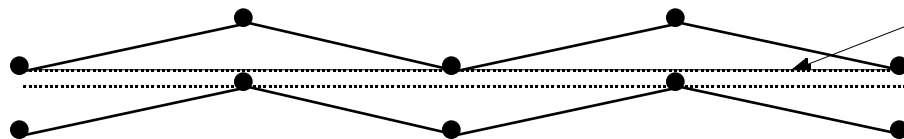
10 Basic Concepts - Horsepower and Handling

Utilize "the Gap" to Help Control Speed

- Use either easy or hard maneuvers to speed up or slow down a course without disrupting the flow.

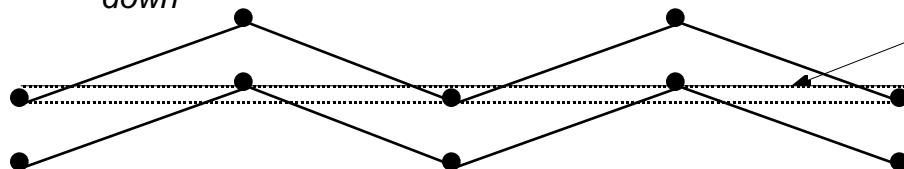
As was mentioned earlier, it is very important to draw scale map. This enables you to figure out where the fast/slow parts really are. Otherwise your course design will just be a fantasy in your mind until the day of the event. Placing it on paper allows you the freedom to actually design your course rather than using the "hit or miss" method.

Version "A"
Speed things up



By increasing this gap, you will effectively increase the speed of the maneuver. A small increase (e.g. one foot) will have a surprisingly large effect

Version "B"
Slowing things down



By increasing this overlap, you will effectively decrease the speed of the maneuver. A small increase here will also have a surprisingly large effect



10 Basic Concepts

7.) Use Pointers and Directionals Correctly and Sparingly

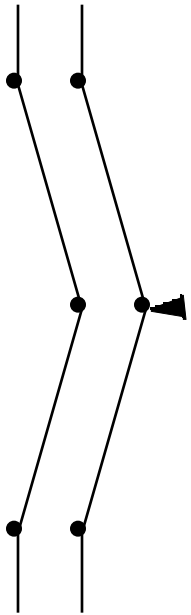
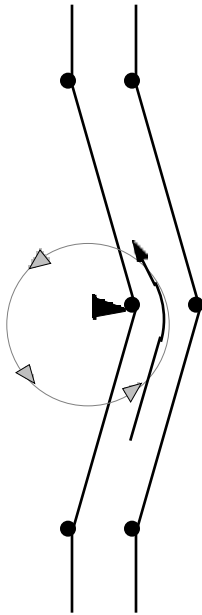
- Pointers
 - The purpose of a pointer cone is ONLY to indicate the inside of a turn (usually near the apex). Use them sparingly.
 - Your car will always turn around a pointer when you negotiate the course if it is placed correctly.
 - I see many people use them as "HEY LOOK AT ME" (HLAM) cones. They will place them on both sides of a gate, which can be confused with a down cone that a worker has not noticed or even make an experienced driver turn the wrong way since pointer cones are supposed to be on the inside of a turn.
- Directionals
 - The purpose of a directional cone is to guide the driver's attention to the left or right
 - The "big secret" to effective use of these is to choose a set number of cones greater than two, (i.e. three) and always use that amount when placing directionals on your course. This way, anytime a driver sees 3 lay down cones, they will know that it is a directional set and not some cones the course workers missed while telling a good joke...

With pointers and directionals, "less is more"

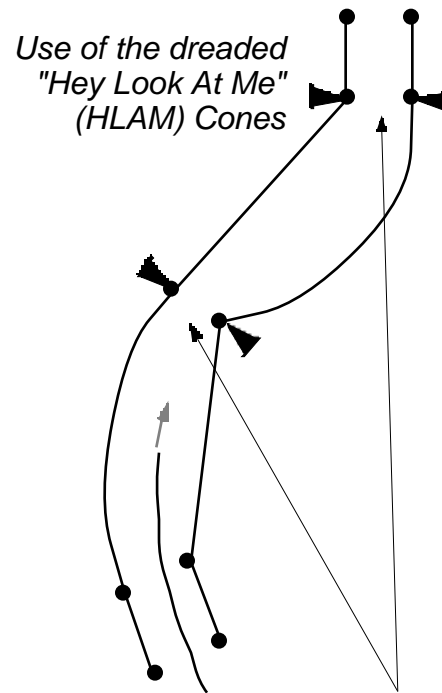


10 Basic Concepts

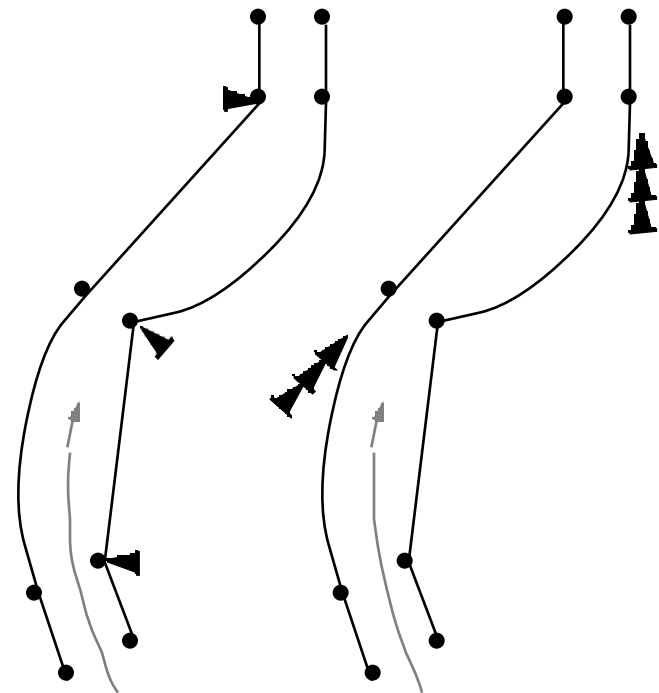
Correct Use of Directionals and Pointers Cones

Incorrect**Correct**

If the pointer cone is placed correctly, the car will always be turning "around the pointer"

Incorrect

*Problem:
Designer needs to draw
attention to these gates*

Correct



10 Basic Concepts

8.) Line the Course

- *Note: If the site that the event is being held at prohibits the lining of a course, please skip to rule 9. If your course is at a location that does allow course lining, please read on.*
-
- Line the course whenever possible. This makes it much easier for the inexperienced driver to make it through the course with out a DNF.
 - Keep in mind, however, that the course should NOT be line dependent. In other words, if it rains the course must still be able to be seen and negotiated successfully if all of the lines are washed away. This is accomplished by paying close attention to basic concept #5.
 - The lining of the course is intended to be a visual aid in basic course negotiation and not an indication of the correct line to drive
 - Care should be taken to avoid the “correct line” from passing over the chalk lines, however. If this happens, you most likely will hear an abundance of complaints and whining about chalk dust.
I have to admit, If I were in an open wheeled/cockpit vehicle, I would be at the front of the line whining with the best of them!
 - The lines should not be so far outside the cones as to fall outside of the driver’s easy field of vision. 1 foot or less is a good guideline to use if lining to the outside of the cones.



10 Basic Concepts

9.) Place Gates to Avoid Visual Confusion

- Do not place cones/gates at interval that are similar to the width of gate being used.
 - If all of your gates are 20' wide, don't place gates going around a sweeping turn 25' or 15' apart. This will create a visual nightmare that I call "Cone Hell" since, at speed, all of the openings appear to be about the same size. Arrrrgh!!! Which one is the gate????
 - To avoid this phenomenon, use the "rule of thumb placement" examples shown on the next page as a guide
- Make all cone walls dense enough so that at any angle, the gaps between them cannot be construed as a gate
- When entering a "box" or walled in turn, place the cones that appear in the approach path closer together and more frequently

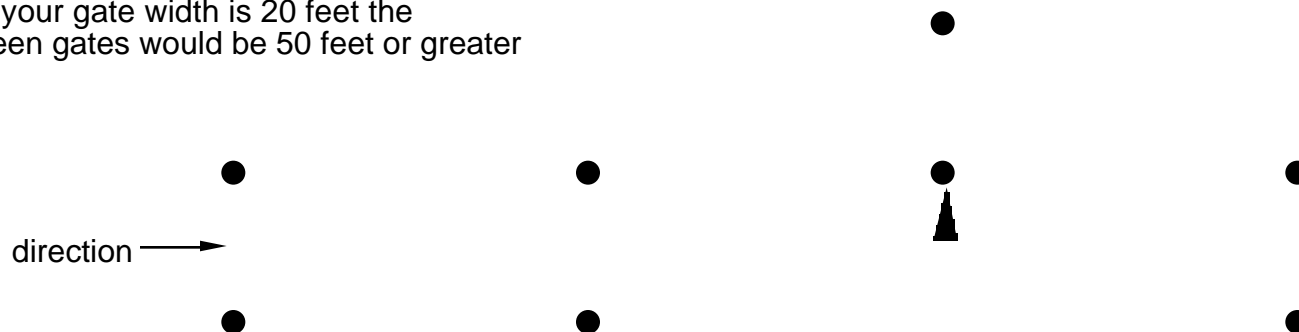
10 Basic Concepts - Avoid Visual Confusion

Gate Spacing "Rule of Thumb"

Gated Courses

Ratio of gate width to gate spacing should be 1 to 2.5 or greater.

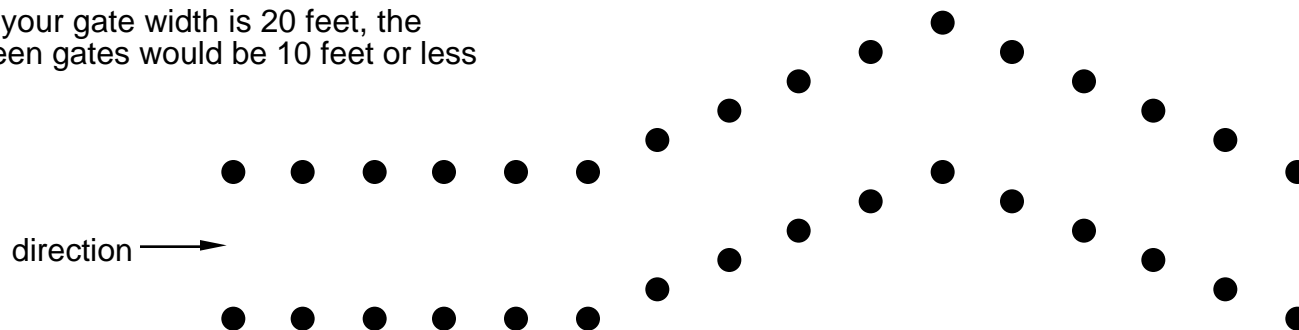
- for example, if your gate width is 20 feet the distance between gates would be 50 feet or greater



Miniature Road Courses

Ratio of gate width to gate spacing should be 2 to 1 or less.

- for example, if your gate width is 20 feet, the distance between gates would be 10 feet or less



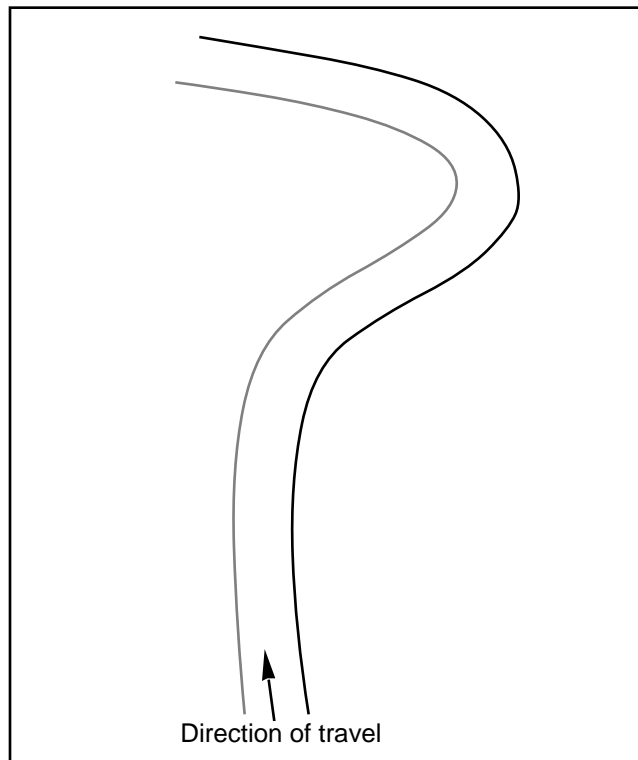


10 Basic Concepts - Avoid Visual Confusion

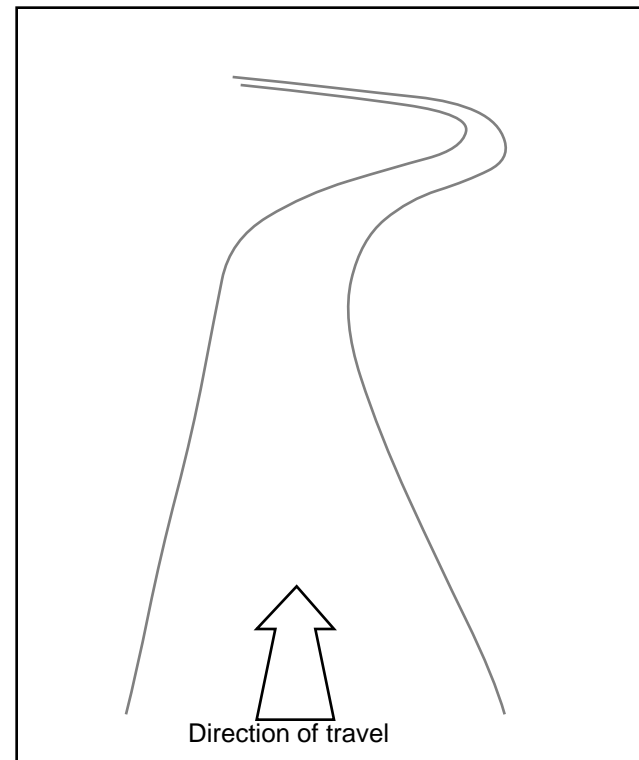
Plan and Perspective views

- The following examples show a plan view and a perspective view of certain situations so that you can better visualize the cone configuration being indicated. What you see below is the basic path that the next 3 examples are going to take.

Plan View



Perspective View



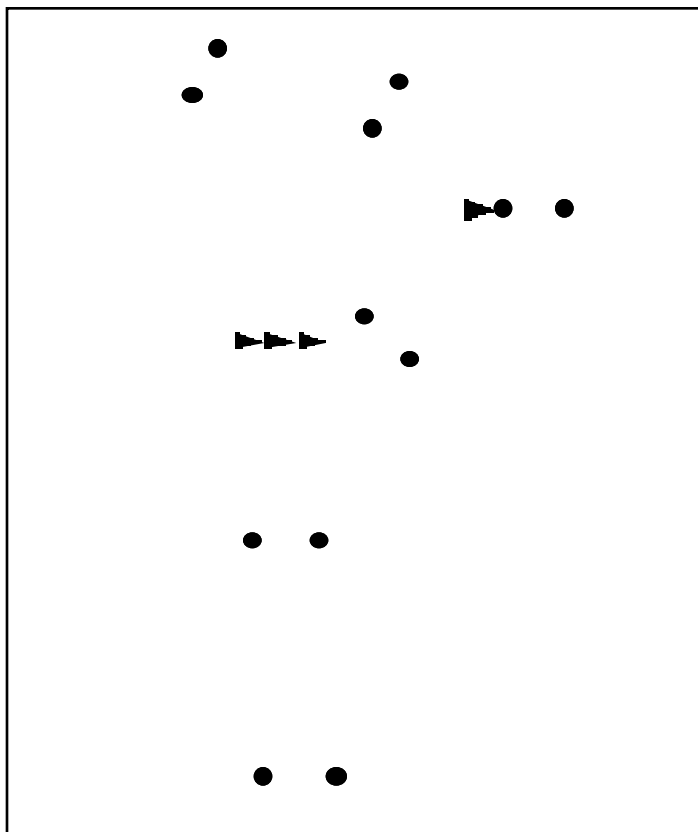


10 Basic Concepts - Avoid Visual Confusion

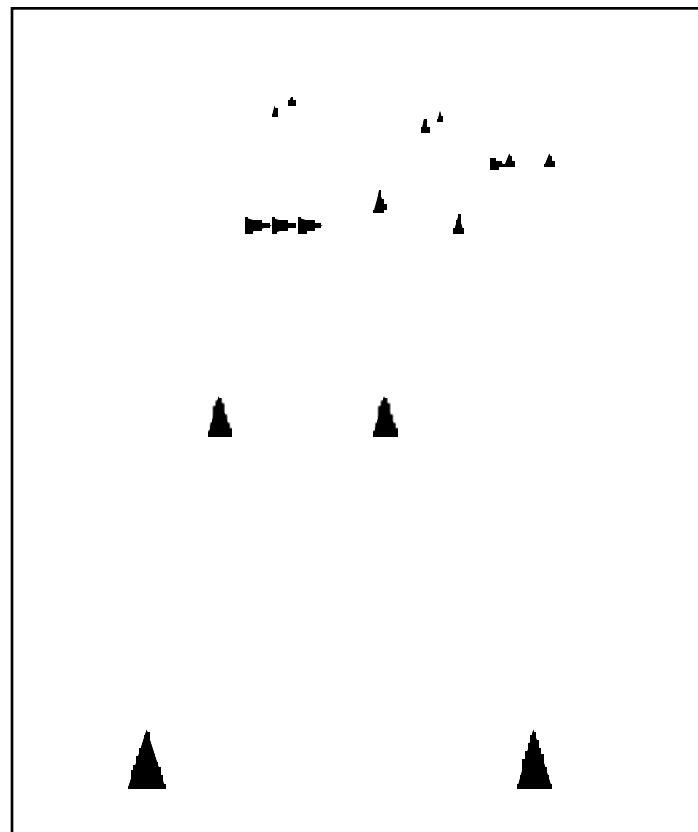
Gates and Pointers

- This is an example of proper use of gates and pointers. The pathway is quite clear and easy to follow

Plan View



Perspective View



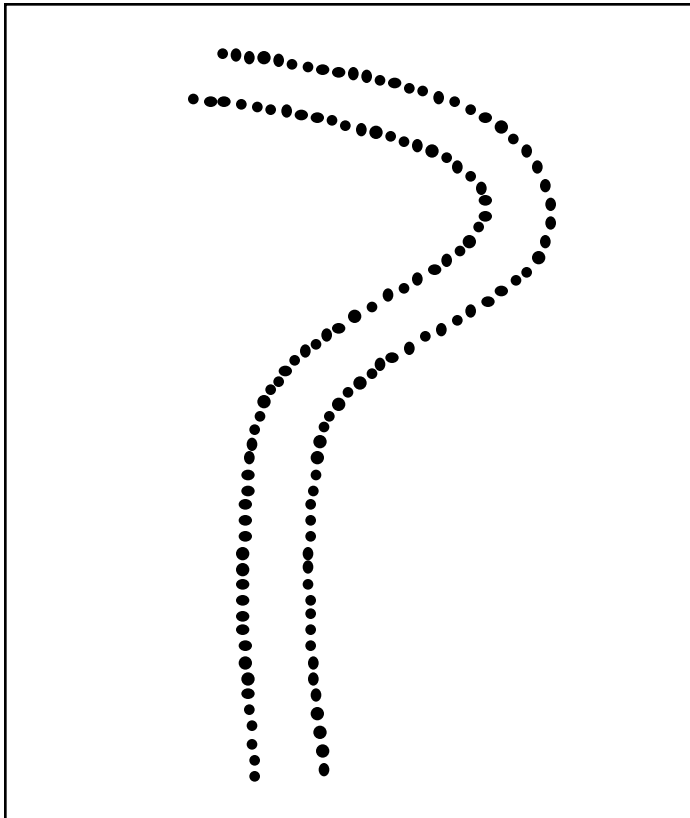


10 Basic Concepts - Avoid Visual Confusion

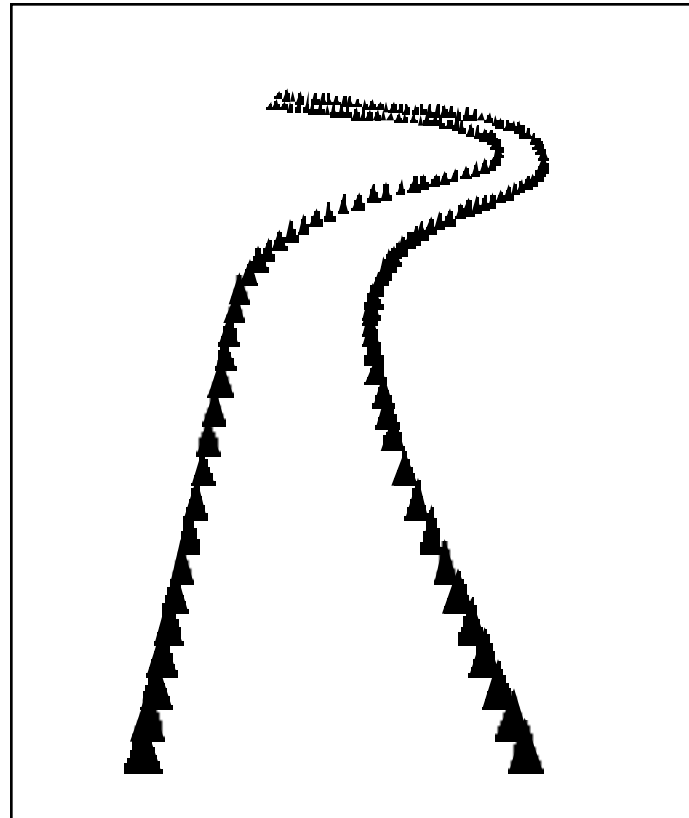
Wall - o - Cones or Miniature Road Course (MRC)

- This is an example of the proper use of the miniature road course technique. The pathway for this is also quite clear and easy to follow

Plan View



Perspective View



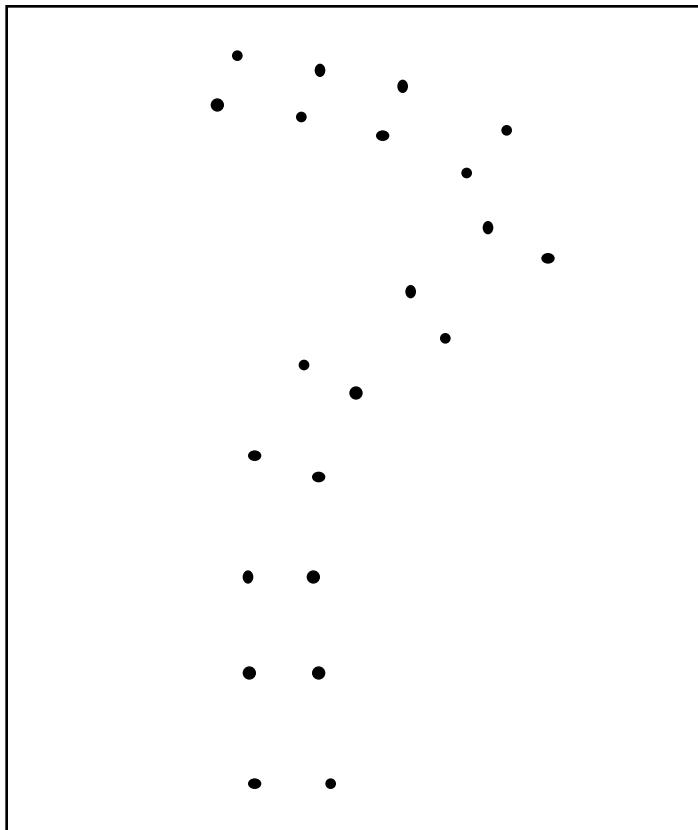


10 Basic Concepts - Avoid Visual Confusion

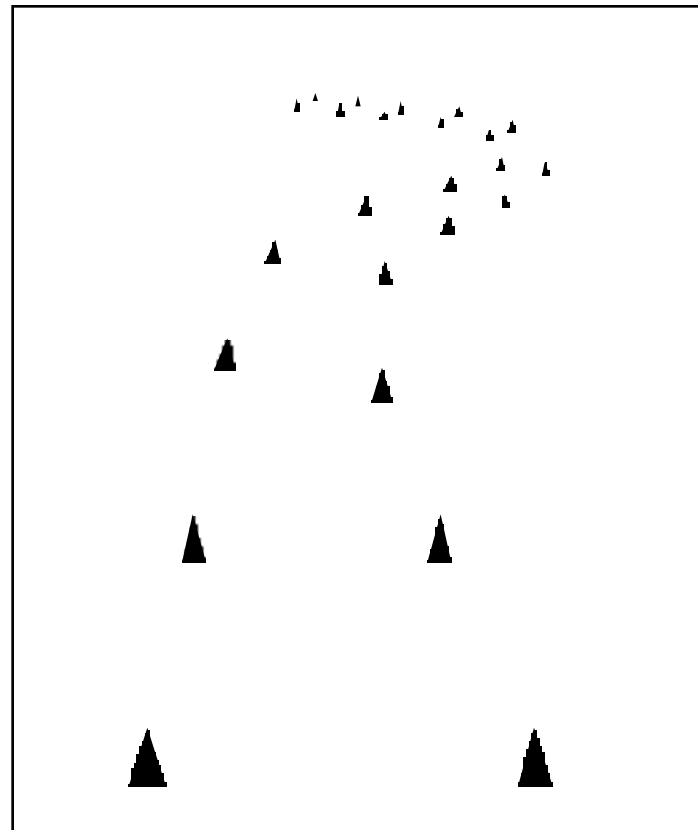
the dreaded "Sea of Pylons"

- The dreaded sea of pylons shown here is the result of using spacing of gates too similar to the gate width. As shown in the perspective view, the curve in the distance becomes vague and difficult to follow. When traveling at speed, this effect is worsened since your mind has less time to process what is placed before it

Plan View



Perspective View



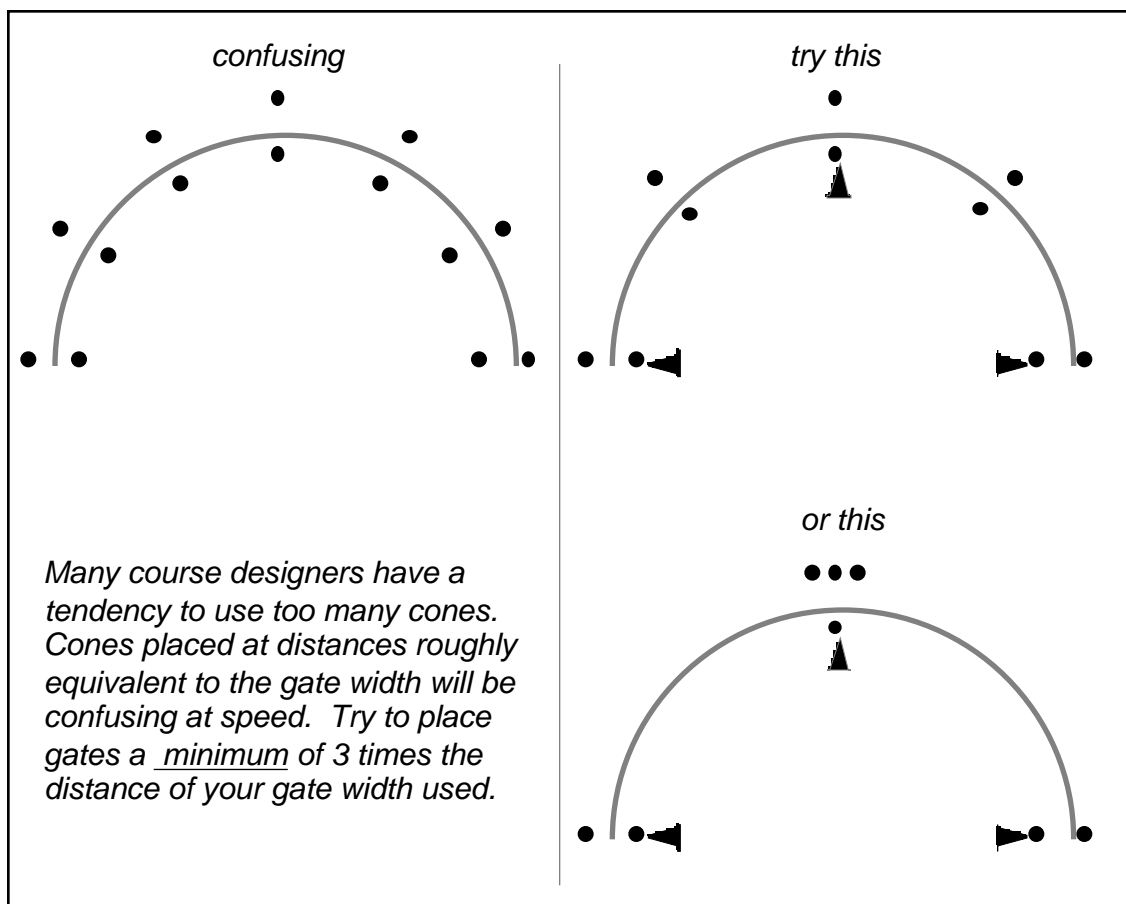


10 Basic Concepts - Avoid Visual Confusion

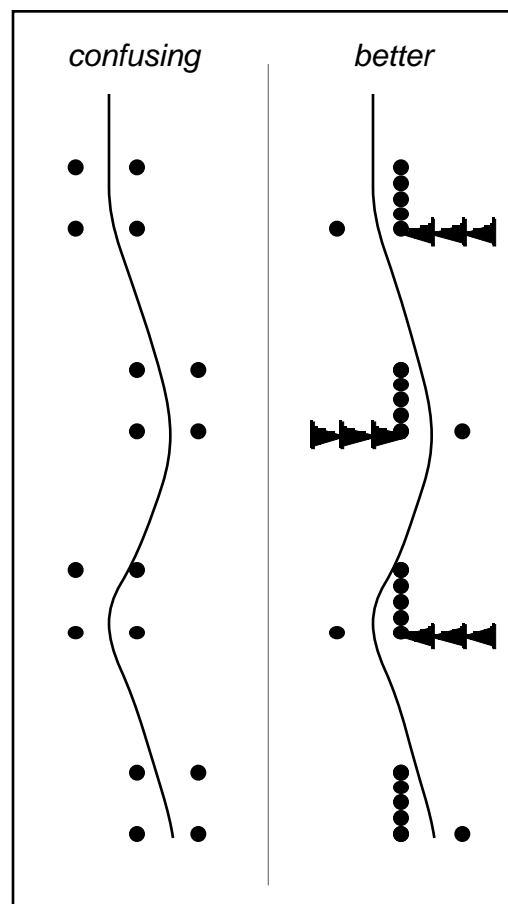
More Examples of "Cone Hell"

Other examples that demonstrate the importance of gate spacing

Sweeper (see page 54)



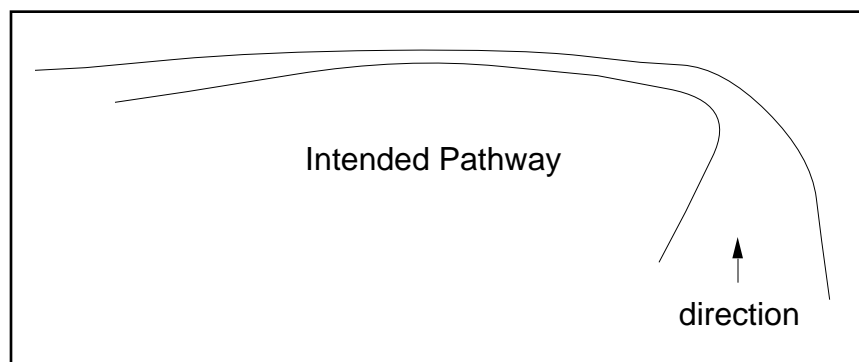
Lane Change (see page 55)



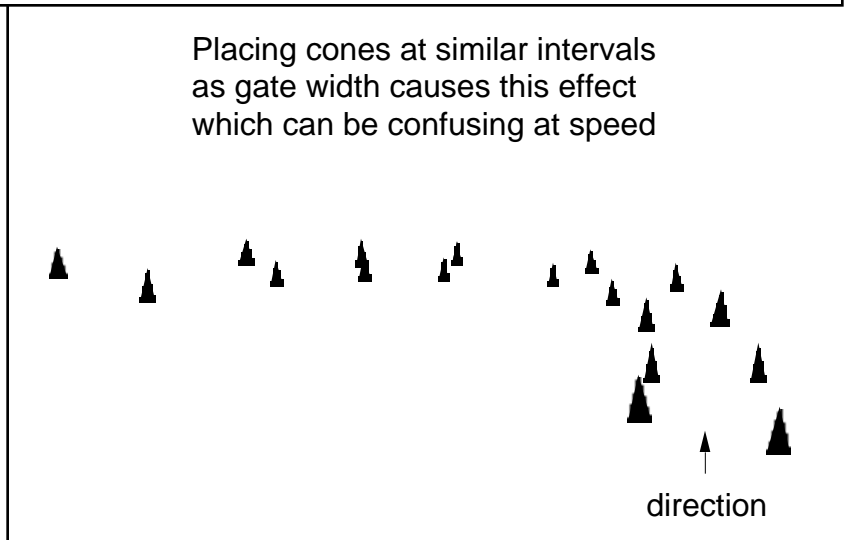


10 Basic Concepts - Avoid Visual Confusion

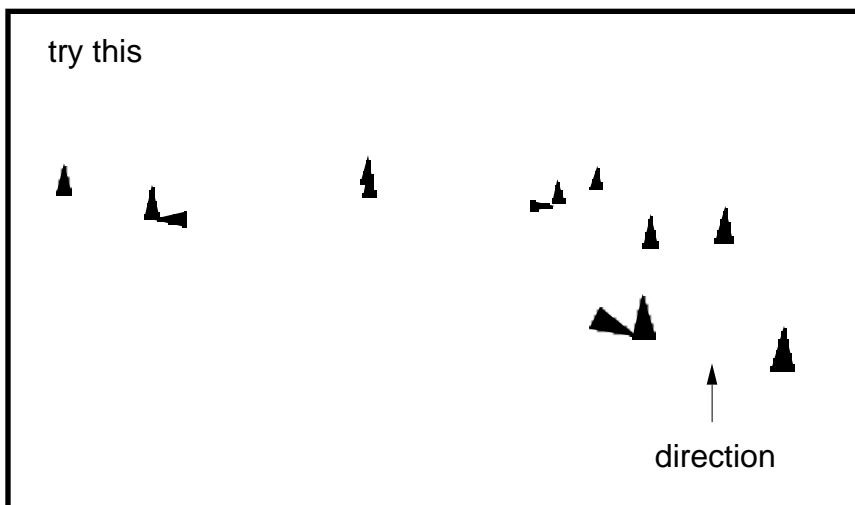
Sweeper - Perspective View



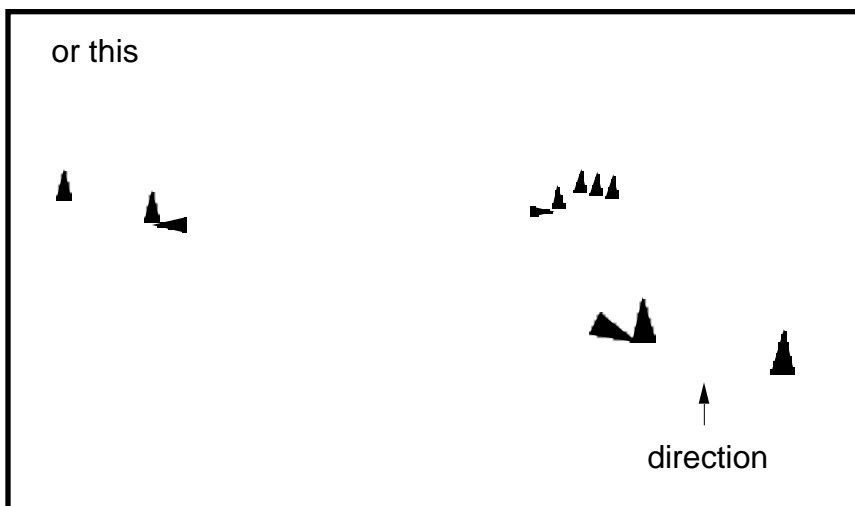
Placing cones at similar intervals as gate width causes this effect which can be confusing at speed



try this



or this

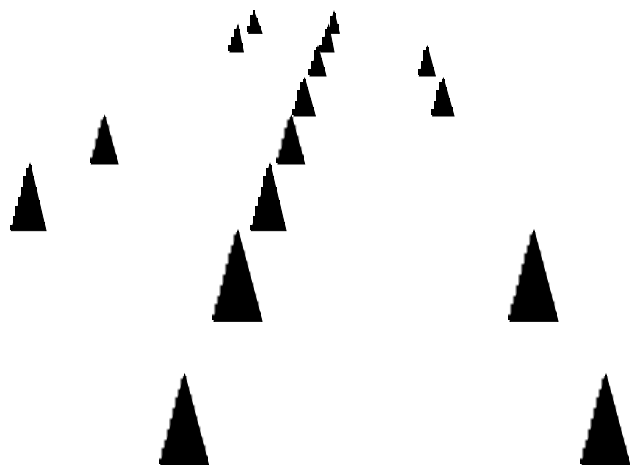




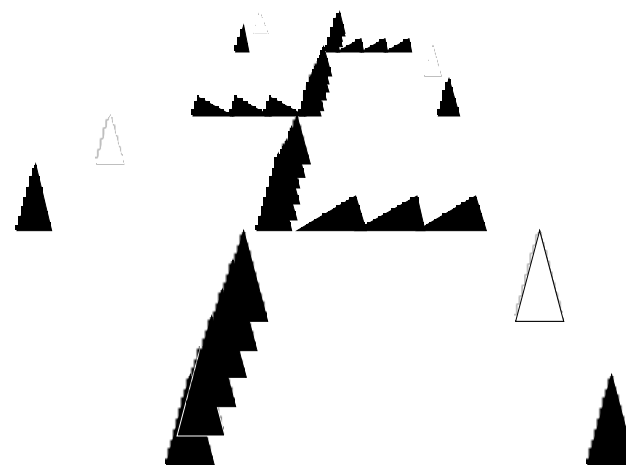
10 Basic Concepts - Avoid Visual Confusion

Lane Change - Perspective View

sea of cones



better

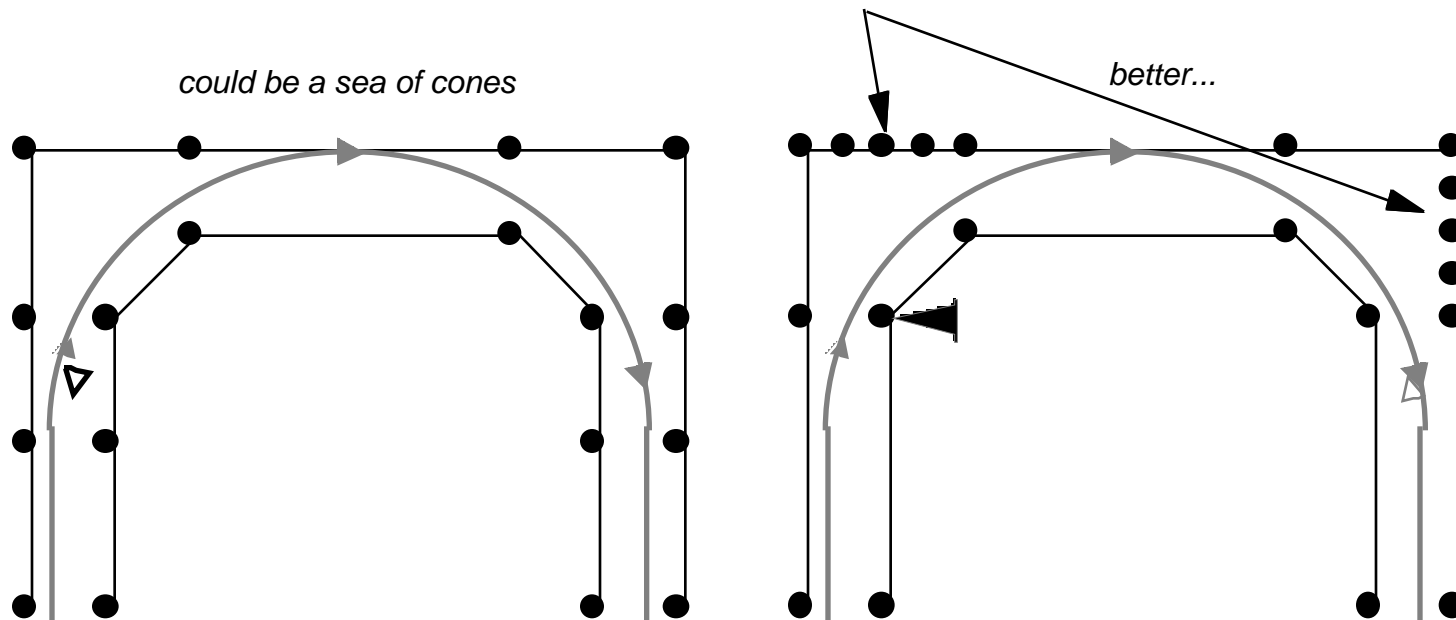




10 Basic Concepts - Avoid Visual Confusion

Box Turns

When entering a “box” or walled in turn
place the cones that appear in the approach path
closer together and more frequently (see page 57)

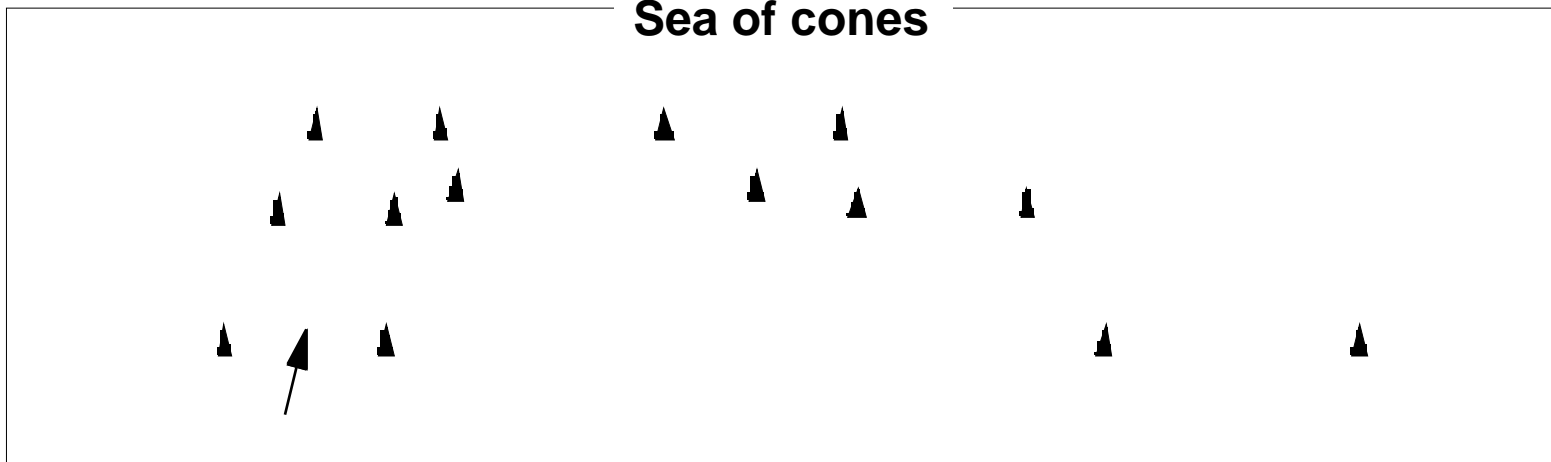




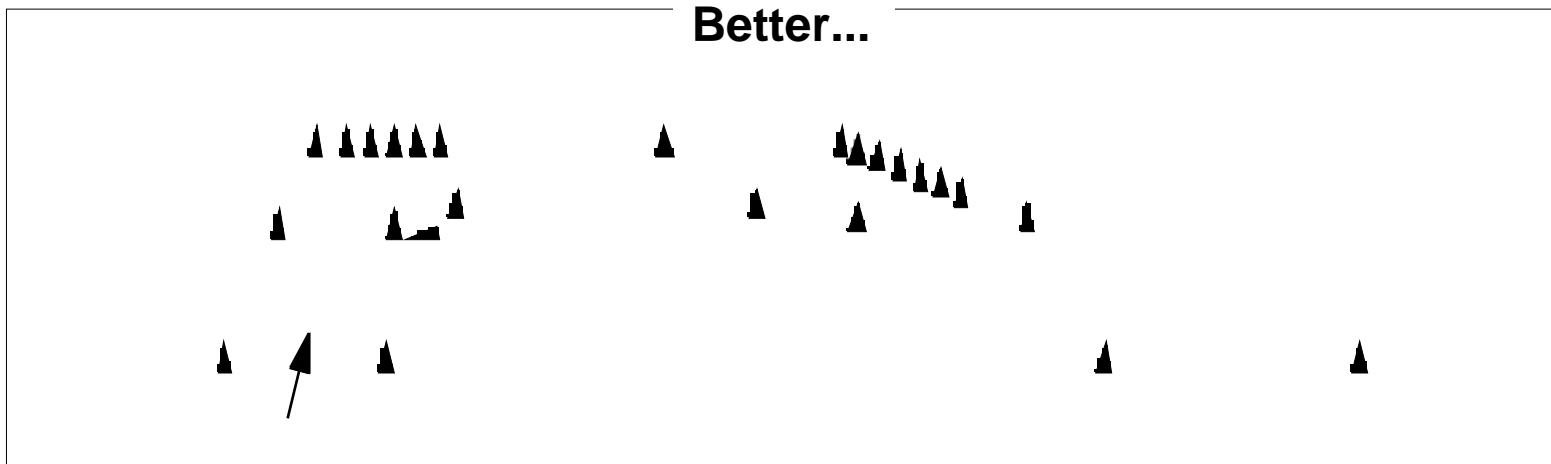
10 Basic Concepts - Avoid Visual Confusion

Box Turns - Perspective View

Sea of cones



Better...



*10 Basic Concepts*

10.) Walk & Drive your course with the Intent of Improvement

- ALWAYS walk and drive your course after its initial set-up with the intent of changing it to improve the flow - and leave your pride at home! I don't think I have ever drawn a course, set it up and not changed at least one thing.
- Keep the _basic concept_ of what your maneuver was, but improve it to make it more fun. Maybe it was too tight, or too fast, or visually hard to see. What ever the shortcoming, this is the perfect time to fix it.
- It is also good to take an experienced course designer and a Safety Steward around with you at this time. That way, you are there when they have a suggestion; you are able to control the types of changes the safety steward comes up with (to maintain the concept of the maneuver); and you can discuss/analyze any of the suggestions the experienced course designer comes up with.
- When not a competitor, DRIVE the course to find its shortcomings. If you are a competitor, designate a non-competitor (whose Solo II opinions you trust) to drive the course. Listen to their inputs carefully and make your design changes based on the inputs received from your walk through, the Safety Steward and your drive through.



Agenda

- Fundamentals
- 10 Basic Concepts
- **So you have a blank piece of paper...**
- Elements, dimensions and real speed
- Summary



So You Have a Blank Piece of Paper

- This section contains a method to use that will enable you to put your ideas and the 10 basic concepts you've just gone over down on a piece of paper. I have found that at times, a blank piece of paper can be extremely intimidating. So, the following section will hopefully alleviate that problem and make this task easier for you as it has for me.



So You Have a Blank Piece of Paper Before You Start Your Glorious Creation

- Make the job easier and improve your chances of success
 - Acquire or make a reasonable scale map of the event site that contains the following information:
 - The *accurate* overall shape and size of the course area
 - Map scale information
 - Dimensions of parking stalls
 - Concrete square dimensions
 - Locations of:
 - Surface problems (grates, holes, oil, etc.)
 - Immovable objects (light poles, buildings, curbs, planters, trees, etc.)
 - Boundary features (fences, sidewalks streets, etc.)
 - Entrance and Exits
 - Elevation changes and/or sloped sections (such as at drainage grates - see page 26)
 - Page 63 has an example of a Map that I created for the 1995 Solo II Nationals North Course Area



So You Have a Blank Piece of Paper Before You Start Your Glorious Creation (continued)

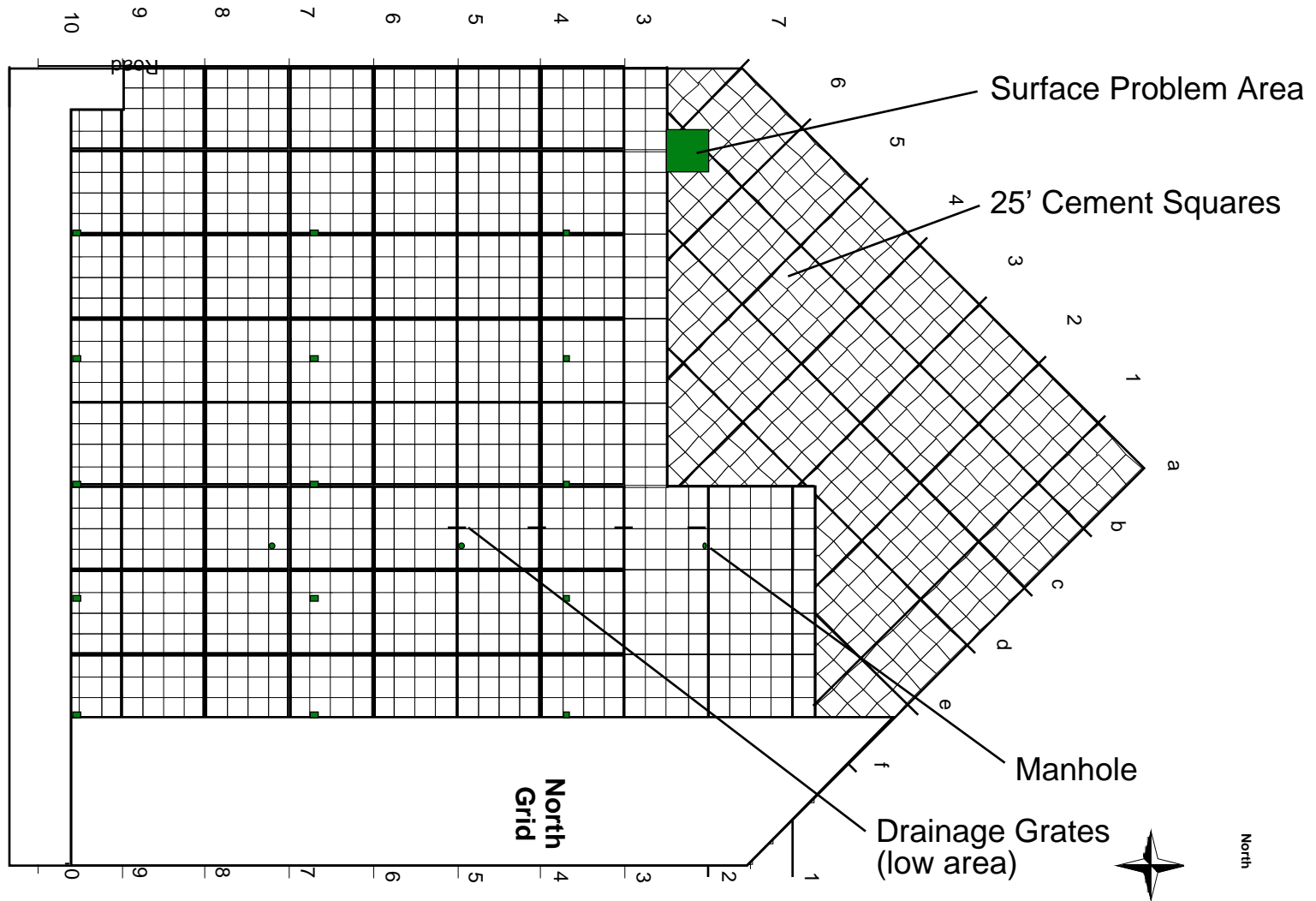
- Address logistics involving non-course features on your map as well
 - Competitor entrance(s) and waiver patrol points
 - Pit areas
 - Grid
 - Run-out for the finish
 - Required boundary buffers for spectator areas
(see pages 22 and 25)
 - Registration location
 - Technical inspection location
 - Timing vehicle/trailer/tent positioning
 - Number of cones available

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CLUB OF
AMERICA

So You Have a Blank Piece of Paper Scale Map of the Topeka North Course Area





So You Have a Blank Piece of Paper

Design Goals

- Consider the course attributes that meet good design goals
 - It follows the ten basic concepts
 - It is easy to find
 - The general route makes sense
 - It can be walked the first time without a course map by an experienced driver
 - It can even be driven by experienced drivers without a walk-through
 - It is easy to remember
 - The sections connect well and make good sense
 - The style and visual clues are consistent and clear
 - Its directional flow leads drivers along the correct path
 - It is hard to drive “right”
 - Lines, discipline, calculated aggression and car control are all critical to having a good competition run
 - Sloppy runs result in slow times
 - Novices are noticeably slower than the experienced drivers in similar cars
- All of these things will provide the competitor with “Fair, Fun and Safe Competition”



So You Have a Blank Piece of Paper How to Keep Your Solo II Peers from Killing You...

Do Not

Get them Lost!

- DO NOT put in lots of extra meaningless pylons to disguise the course
- DO NOT space pylons the same or similar distance as the gate width
- DO NOT forget to line the course

Do Not

Make them hit (and pick up) lots of pylons!!

- DO NOT place a cone (s) with the only intent of “boy, will THAT one get creamed!”
- AVOID the effect known as the “Sea of Pylons”



So You Have a Blank Piece of Paper How to Keep Your Solo II Peers from Killing You... (continued)

- Visit the site ahead of time
- Draw the course to scale (or as close as possible) and include:
 - Worker positions
 - Start and Finish
 - Grid
 - Paddock
- Let some other non-emotionally involved person review your course
- Set up early
- Walk the course while pretending some other idiot designed it
 - Look for visually confusing areas
 - Add pointers or adjust pylons as needed
 - Remove pylons as needed
- Have someone else walk the course and adjust according to their comments as necessary
- Then, line the course



So You Have a Blank Piece of Paper Getting Started (Finally...) Position the Finish

- Position the finish area first
 - Things to think about
 - Runoff area
 - Exit from the course area (tightly defined)
 - Return route to grid
 - Location of lights
 - To provide good timing stop location
 - To avoid impact by badly controlled cars
 - Separation limited by equipment capability
 - What type of finish?
 - flying finish
 - finish after turn
 - etc.
 - Avoid maneuvers which encourage control loss or requires heavy application of the brakes just before the lights
 - Try to ensure that the projected timing vehicle location will have a clear view of the finishing cars



So You Have a Blank Piece of Paper

Position the Start

- Position the start area next
 - Things to think about
 - Staging line
 - Access from the grid
 - Location of the start/finish lights
 - Provide a logical timing start location
 - Separation of the timing lights limited by equipment capability, not the course's edge
 - What kind of start?
 - 90°
 - Drag strip
 - short approach
 - etc.
 - Try to ensure that the projected timing vehicle location will have a clear view of the starting (and finishing) cars



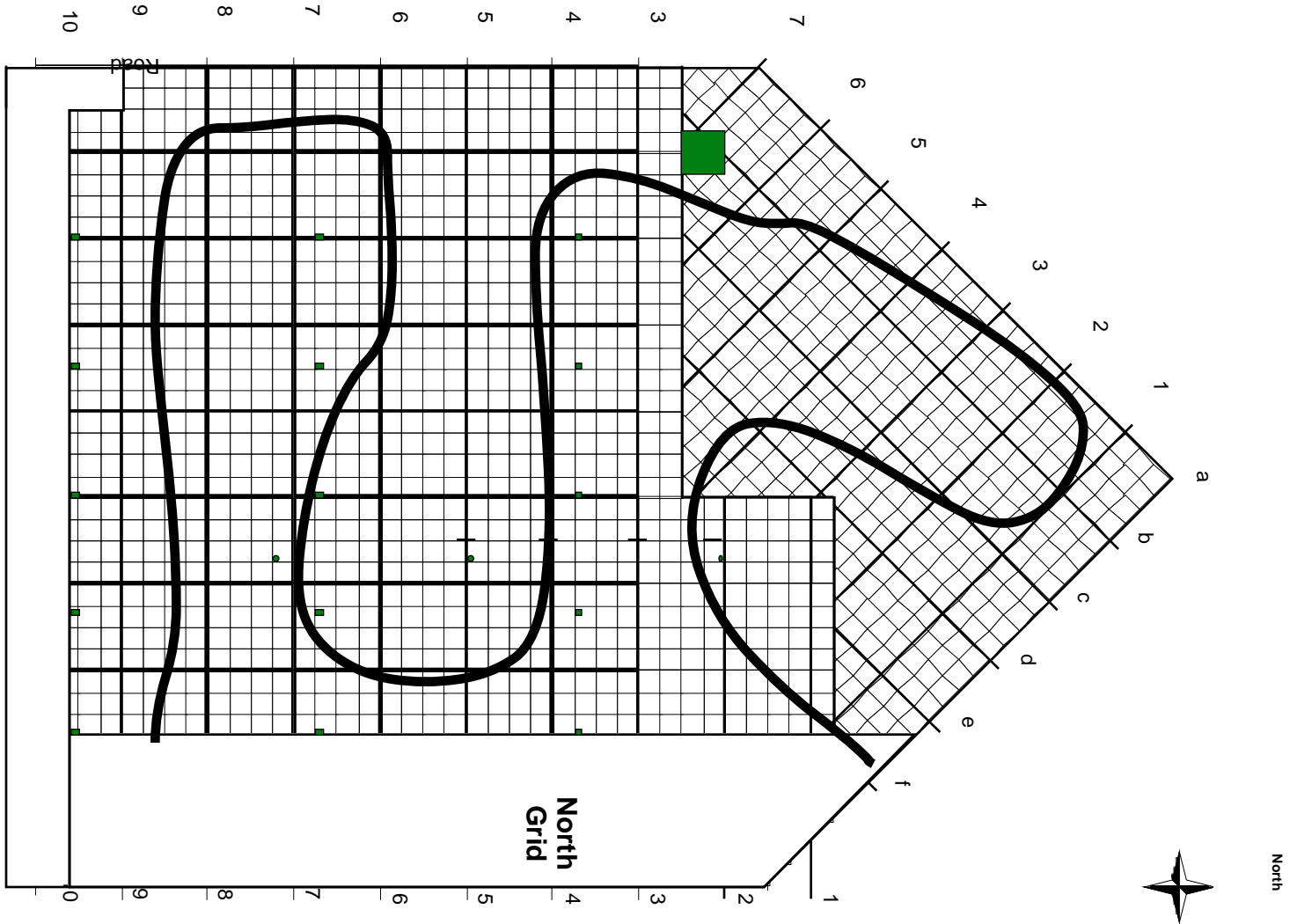
So You Have a Blank Piece of Paper Sketch General Routes Through the Site

- Determine number and directions of turns
- Consider the location of the straightish sections
- Anticipate possible course worker station positions
- Keep in mind distance to boundaries and immovable objects
- Allow for multiple cars on course if necessary
 - Avoid crossovers
 - Provide separation between adjacent sections
- Provide a variety of different types of maneuvers
 - Make a list of the desired items for the course
 - Decide which portions of that route lend themselves to each of the listed elements
- Do several general sketches - there is no single “right” route
- Pick the ones that seem the best and fill them in
 - Adjust turn radii and shapes
 - Add transients where applicable
 - Ensure a diversity of elements
- Decide what your presentation format is and be consistent
 - Gate style (line or unlined)
 - Walled style (lined or unlined)
 - A combination thereof



So You Have a Blank Piece of Paper

Example of a sketch





So You Have a Blank Piece of Paper

Finalizing the Design

- Add projected cone locations
 - Think about visual cues and clear markings (*see page 47 - 57*)
 - Don't assume that the white chalk line will help guide the drivers
 - Rain or wind may eradicate those lines during an event
 - Consider approach speeds and allow some room for driver error (*see page 27*)
 - Create patterns by repeating cone formations
 - Pointers on apexes
 - Four cone walls on outside of turns
 - Consistent gate widths, etc.
 - Avoid Excess cones where not required
 - Prioritize key cones (*see pages 33 and 34*)
 - Allow room for adjustment in all directions; no course should be expected to be set up on site exactly as it was drawn on the map
 - 10' minimum movement allowance
 - Individual cones and or gates
 - Entire sections

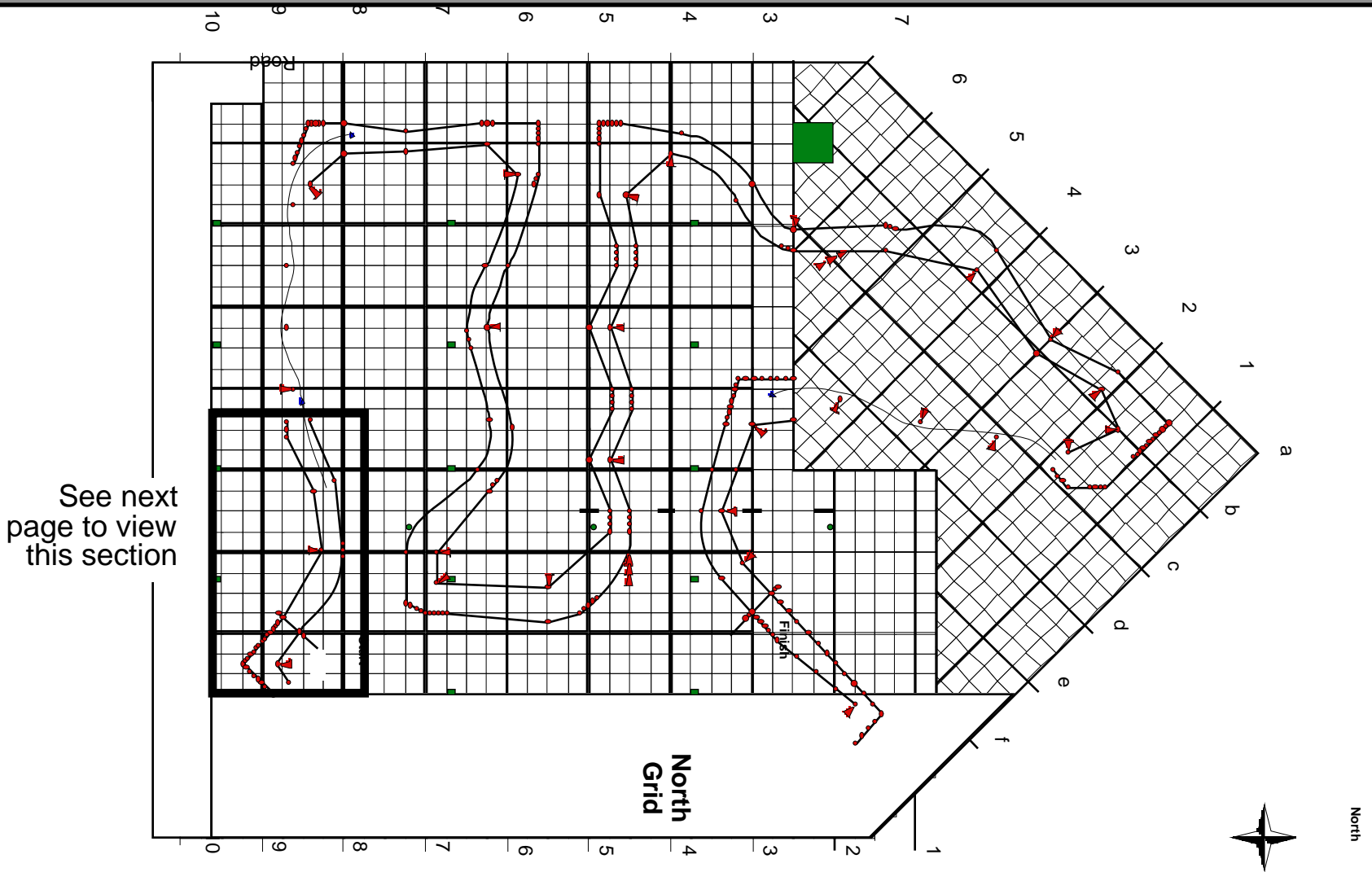
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So You Have a Blank Piece of Paper

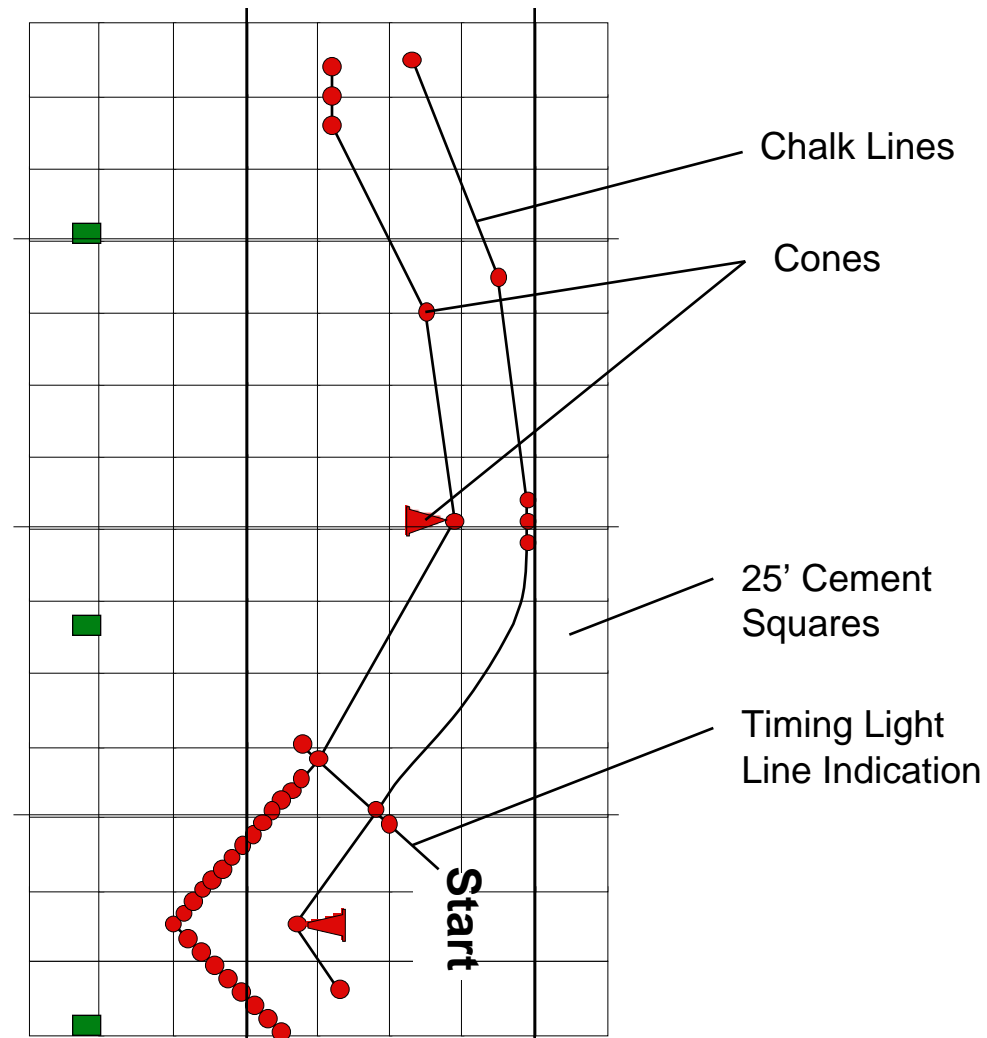
Finalized Design Example





So You Have a Blank Piece of Paper

Section from Finalized Design





So You Have a Blank Piece of Paper

Worker stations

- Now add the projected course worker stations and projected coverage area
 - Keep coverage distances around 50 yards or less if possible
 - Position near solid objects if possible/available
 - light pole
 - tree
 - planter, etc.
 - Locate workers on the inside of a turn rather than the outside
 - Anticipate possible directions that a car may spin and avoid those areas
 - Prioritize closeness to the cones likely to be hit
 - slalom cones
 - tight apexes
 - outside walls at ends of significant straights, etc.
 - Try to ensure that workers do not have to cross another area of the course to get to a down cone in their coverage area

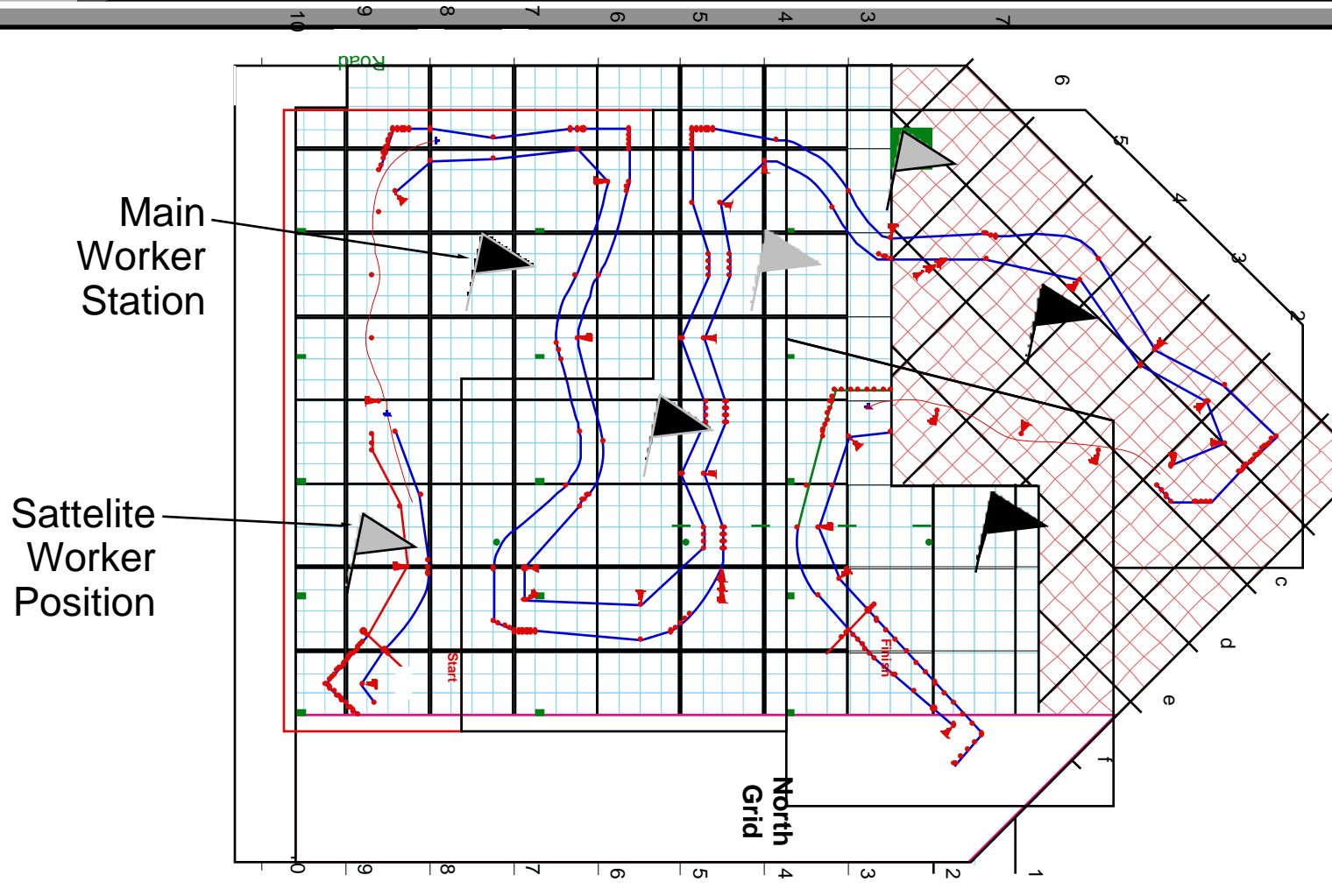
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Worker Station Placement



North



So You Have a Blank Piece of Paper

Course Set Up at the Event Site

- Things are not always what they seem...
(or I could have sworn they'd have to lift there)
 - Part of being a course designer is to be surprised. It is rare to be able to say that the entire design worked the way it was intended. Page 72 shows a course I designed. The first section turned out to be flat out from the start until the first 90° turn. Not what I expected at all!
 - Some elements which appear to contain maneuvers that reduce speed on paper may in fact be wide open, as I found out from my example above. Remember, your map has cones on it that are approximately 5 feet in diameter - which makes it hard to be real accurate
 - The converse is true too - Some elements which appear to be moderately open will be difficult and tight to drive
 - Sometimes it is difficult to spot poor sections on paper but easy to see once the pylons are in place. A good designer will exhibit flexibility and make on-site adjustments to allow the course to flow properly (*see pages 77-79*)
 - So make adjustments at the event site, make note of your errors and your course designs will benefit



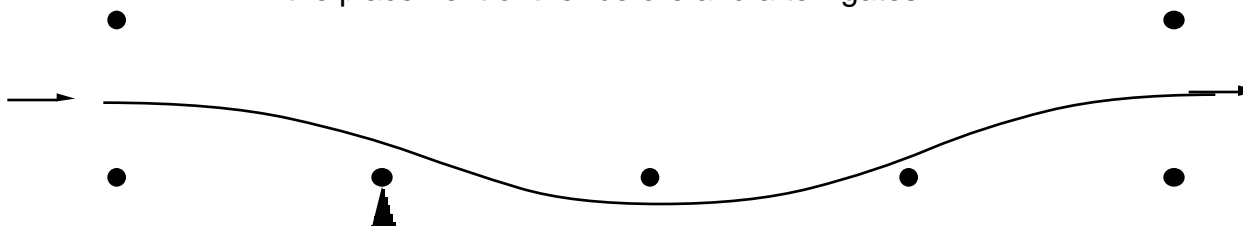
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The "Before and Afters"

- Placement of the gate "before and after" the start and finish of a slalom is critical as to the amount of turns that the slalom actually becomes.

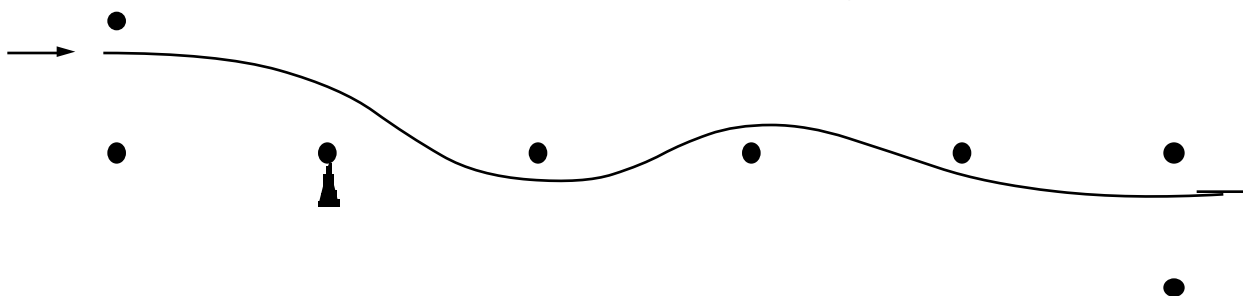
3 Cone Slalom

The intent of a three cone slalom is usually to make 3 turns. As you can see from this example, this slalom has become 1 turn due to the placement of the "before and after" gates



4 Cone Slalom

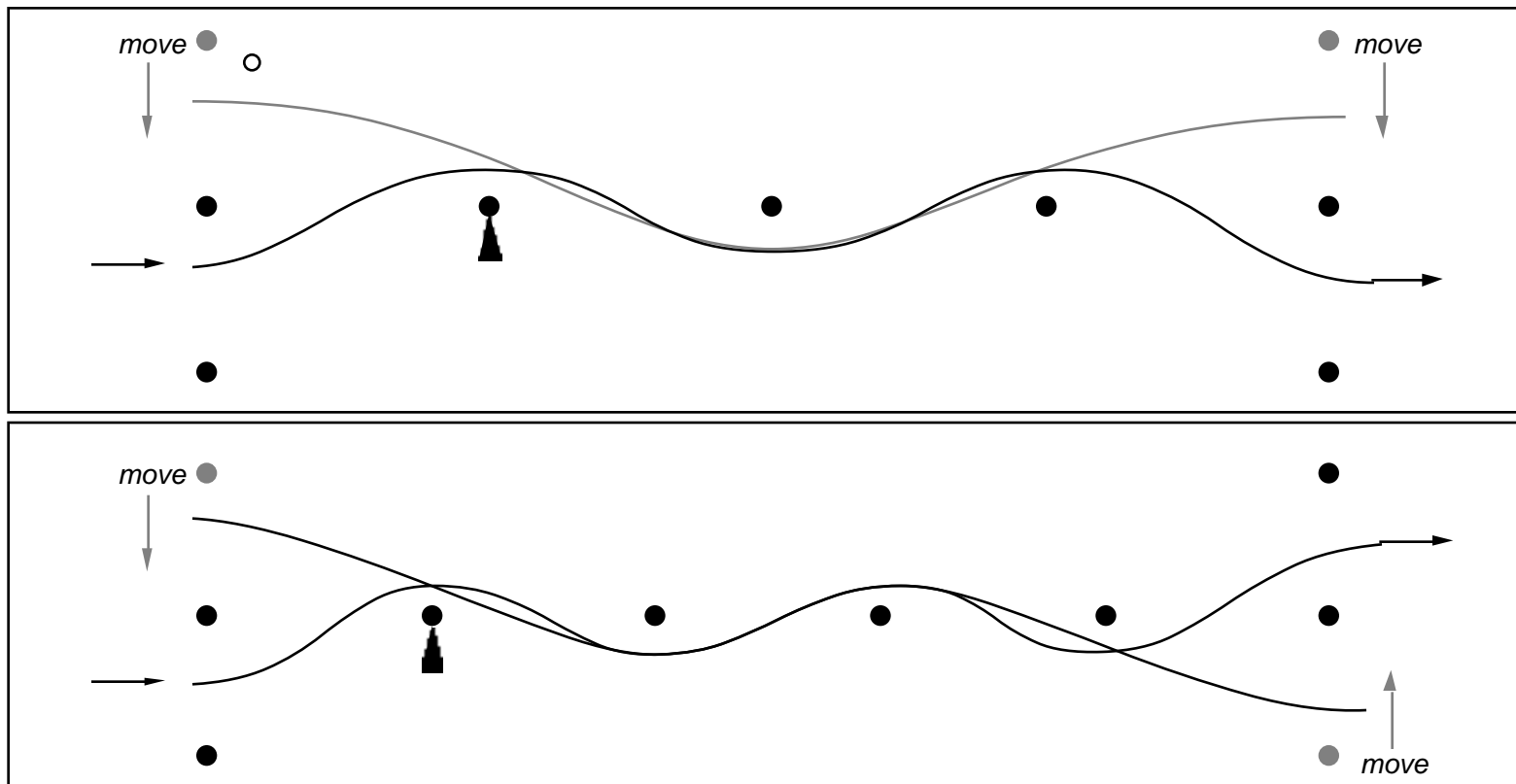
The intent of a four cone slalom is usually to make 4 turns. As you can see from this example, this slalom has become 2 turns due to the placement of the "before and after" gates





So You Have a Blank Piece of Paper Tweak the “Before and Afters” at the Event Site

- Note that the three cone slalom now has 3 turns and the Four cone slalom has 4 turns. By tweaking the placement of these two gates at the event site, you can increase/decrease the severity of a slalom just by moving either or both of these gates a few feet to get the flow you want.

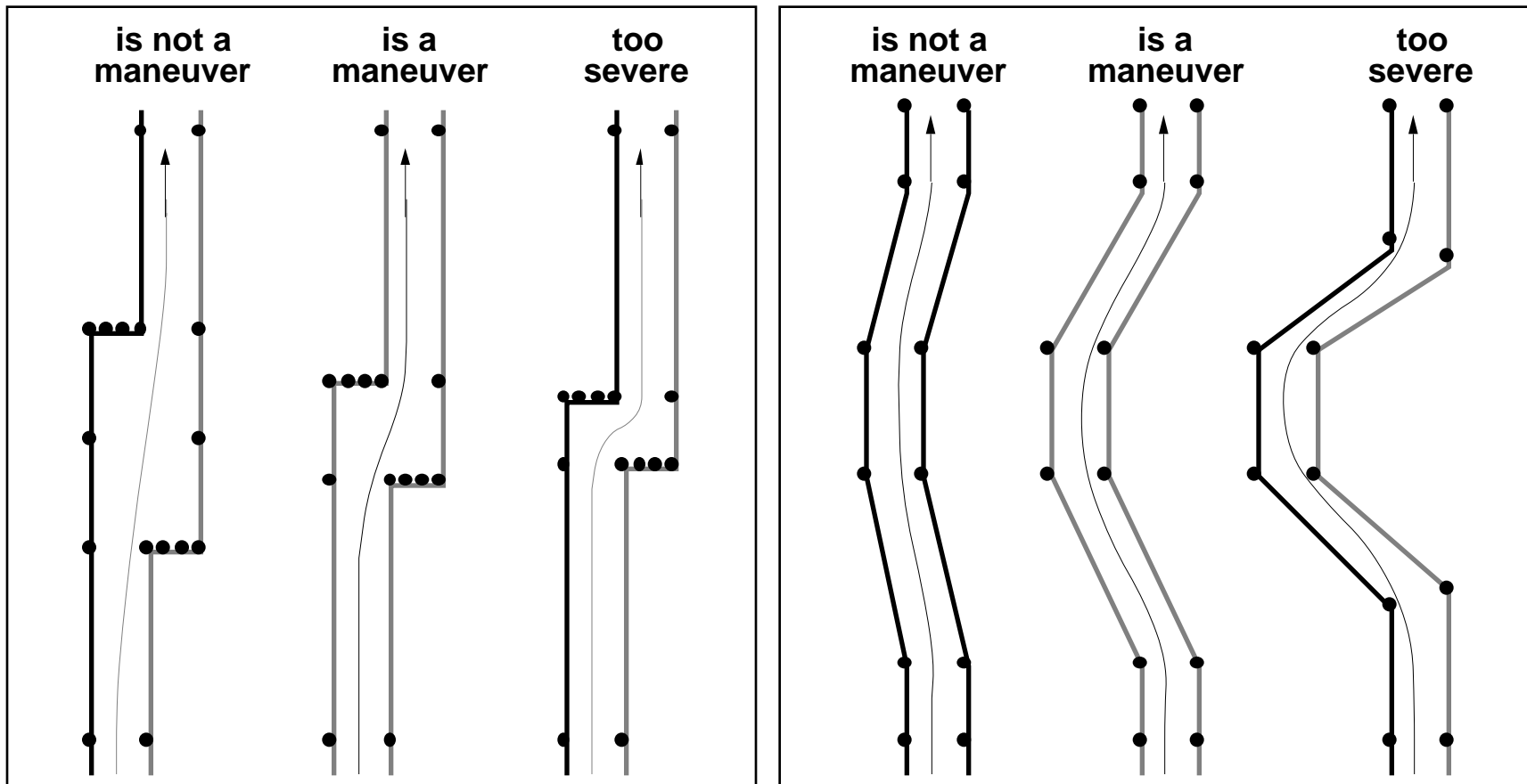




So You Have a Blank Piece of Paper

When a Maneuver isn't...

- While setting up your course, check to see that all maneuvers are indeed maneuvers. Also ensure that they are not more severe than you intended





Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a blank piece of paper...



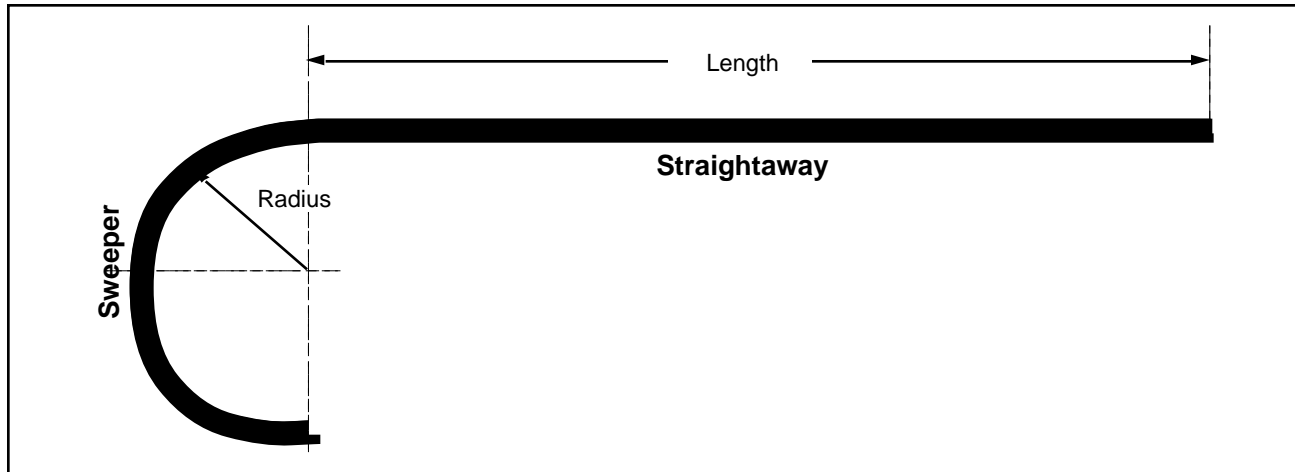
- **Elements, dimensions and real speed**

- Summary



Element Dimensions and Real Speed

- This section of the book will address is how you, as a course designer, can relate course content and size to how fast the competitors cars might actually go
 - You “Techno-Weenies” (TW) are gonna love this
 - If you are not a TW, this section is still important to understand. It has a real life example as to why you must make your courses “equalizer courses” as outlined in the 6th basic concept *(see pages 41 - 43)*
- This section will address:
 - Sweeper speeds
 - Radius of a turn
 - Cornering G’s of a car
 - Straightaway speeds
 - Length of straight
 - Acceleration times





Element Dimensions and Real Speed

Disclaimers

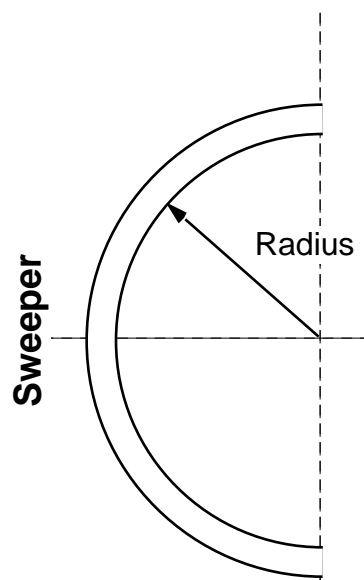
- All calculations shown in this section are based on Car magazine road test data.
- The variables include:
 - Type of surface used for testing
 - Type and size of the tires on the car
 - Preparation level of the car
 - shocks
 - alignments
 - bushings, etc.
 - Abilities of the test driver
- Approximations are inherent in the methods used
 - Sweepers are not usually constant radius arcs
 - Straights often are not perfectly straight
- What makes a quick autocross car is not just pulling high G's and acceleration



Element Dimensions and Real Speed

Sweeper Speeds

- The relationship of the radius of the turn and the cornering G's is shown in the table below:

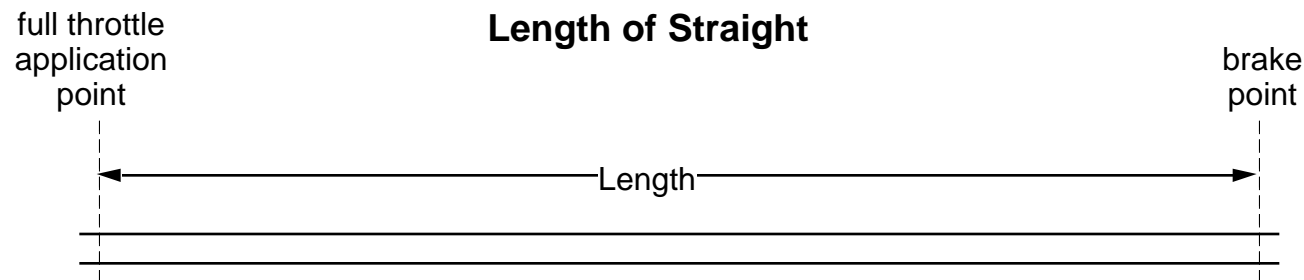


		Miles per hour		
		Radius 50'	Radius 75'	Radius 100'
G Force	0.90	25.9	31.7	36.6
	0.85	25.1	30.8	35.6
	0.84 (Camaro)	25.0	30.6	35.3
	0.82 (Sentra)	24.7	30.2	34.9
	0.80	24.4	29.9	34.5



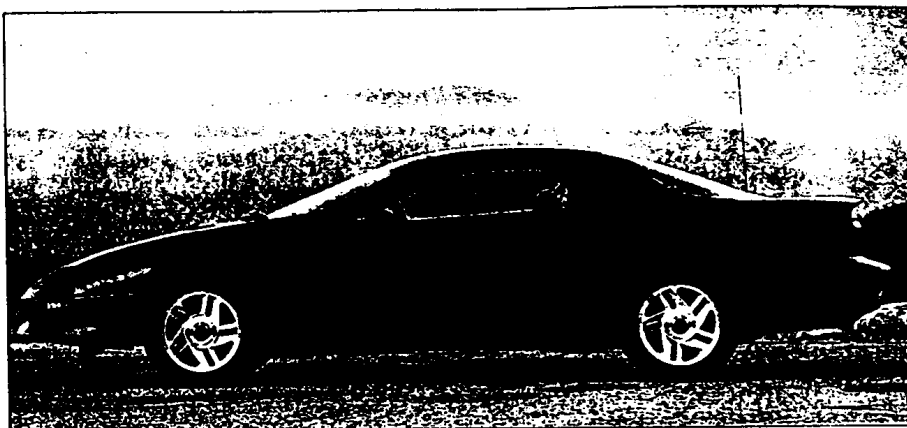
Element Dimensions and Real Speed

Straightaway Speeds



- Acceleration times
 - Magazine test data (*see pages 85 and 87*) usually include times for:
 - 0 - 30 mph
 - 0 - 40 mph
 - 0 - 50 mph
 - 0 - 60 mph
 - 0 - 70 mph
 - Calculation of distance covered is based on the area beneath the curve on a plot of velocity versus time (*see pages 86 and 88*)

TECH DATA



'93 Chevrolet Camaro Z28

Make and model	Chevrolet Camaro Z28
Manufacturer	Chevrolet Division
	General Motors Corp., Detroit, Mich.
Location of final assembly plant	St. Therese, Quebec, Canada
Body style	2-door, 4-passenger
Drivetrain layout	Front engine, rear drive
Base price	\$17,195 (est.)
	\$19,812 (est.)
Option	Dodge Daytona IROC R/T
	Talon TSi

Suspension	
Front	Upper and lower control arms, coil springs, anti-roll bar
Rear	Solid axle, multilink with trailing arms and track bar, coil springs, anti-roll bar
Steering	
Type	Rack and pinion
Ratio	14.4:1
Turns, lock to lock	2.3
Turning circle	39.0
Brakes	
Front, type/dia., in	Vented discs/10.9
Rear, type/dia., in	Vented discs/11.4
Standard tires	Standard
Optional tires	
Optional	

PERFORMANCE AND TEST DATA

Acceleration, sec

0-30 mph	2.7
0-40 mph	3.6
0-50 mph	4.9
0-60 mph	6.2
0-70 mph	8.2
0-80 mph	10.0
0-90	12.7

Standing quarter mile

sec @ mph 14.7 @ 96.9

Braking, ft

30-0 mph	31
60-0 mph	110

Handling

Lateral acceleration, g 0.84

Speed through 600-ft slalom, mph	63.6
----------------------------------	------

Speedometer error, mph

Indicated	Actual
30	30
40	40
50	50
60	60

Interior noise, dBA

Idling in neutral	62
Steady 60 mph in top gear	75

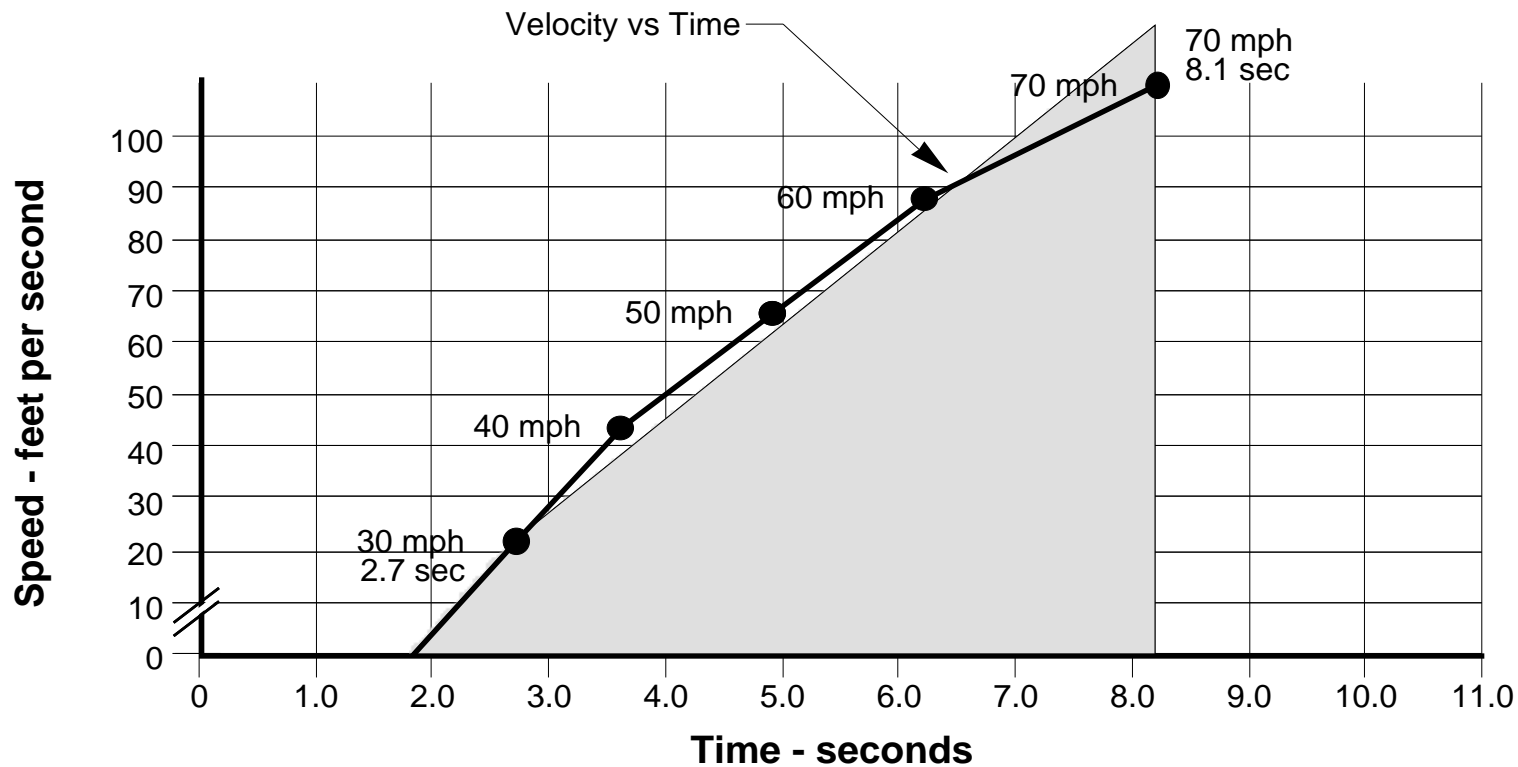
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Element Dimensions and Real Speed

Camaro Velocity vs. Time



**Under full acceleration from 30 to 70mph,
the Camaro will travel 426.25 feet in 5.5 seconds**

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Element Dimensions and Real Speed

Sentra Specifications

NISSAN SENTRA SE-R

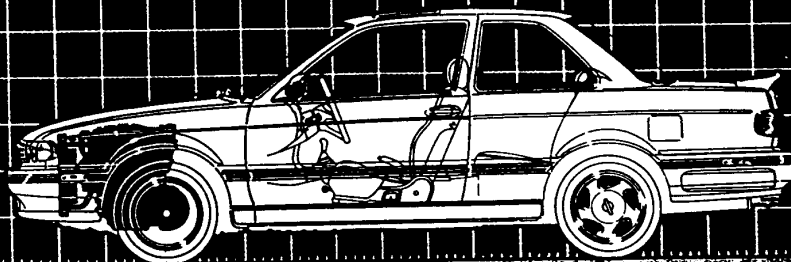
PRICE

List price, all POE \$11,370
Price as tested est \$14,290
Price as tested includes std equip. (AM/FM stereo/
cassette, elect. aid mirrors, air cond (\$850), power sun-
roof (\$800), ABS (\$200), CD player (est \$450). Call
emissions \$711. Dealer's prep wheel \$50.

IMPORTER

0-60 mph 8.1 sec
0-¼ mi 16.2 sec
Top speed est 125 mph
Skidpad 0.82g
Slalom 60.2 mph
Brake rating very good

SCALE: 16 in (254 mm) DIVISIONS
DRAWING BY BILL DOBSON



DRAWING BY BILL DOBSON

ENGINE

Type aluminum head & block
Displacement 1.8 L
Cylinders 4
Valves 16
Horsepower 122 @ 1900 rpm
Torque 122.6 ft-lb / 1998 cc
Bore x stroke 3.39 x 3.39 in /
86.0 x 86.0 mm
Compression ratio 9.5:1

DRIVETRAIN

Transmission 5-sp manual
Gear 1st 3.06:1
2nd 1.83:1
3rd 1.29:1
4th 1.00:1
5th 0.76:1
Overall ratio 12.79:1
7.63:1
5.37:1
4.07:1
3.16:1
Rpm / Mph
(7500) 38
(7500) 63
(7500) 90
(7500) 119
est (6150) 125
4.18:1
2950

ACCELERATION

Time to speed Seconds
0-30 mph 2.7
0-40 mph 3.4
0-50 mph 5.9
0-60 mph 8.1
0-70 mph 10.8
0-80 mph 13.6
0-90 mph 17.6
Time to distance
0-100 ft 3.3
0-500 ft 8.7
0-1320 ft (¼ mi) 16.2 @ 87.0 mph

ACCUMODATIONS

BRAKING

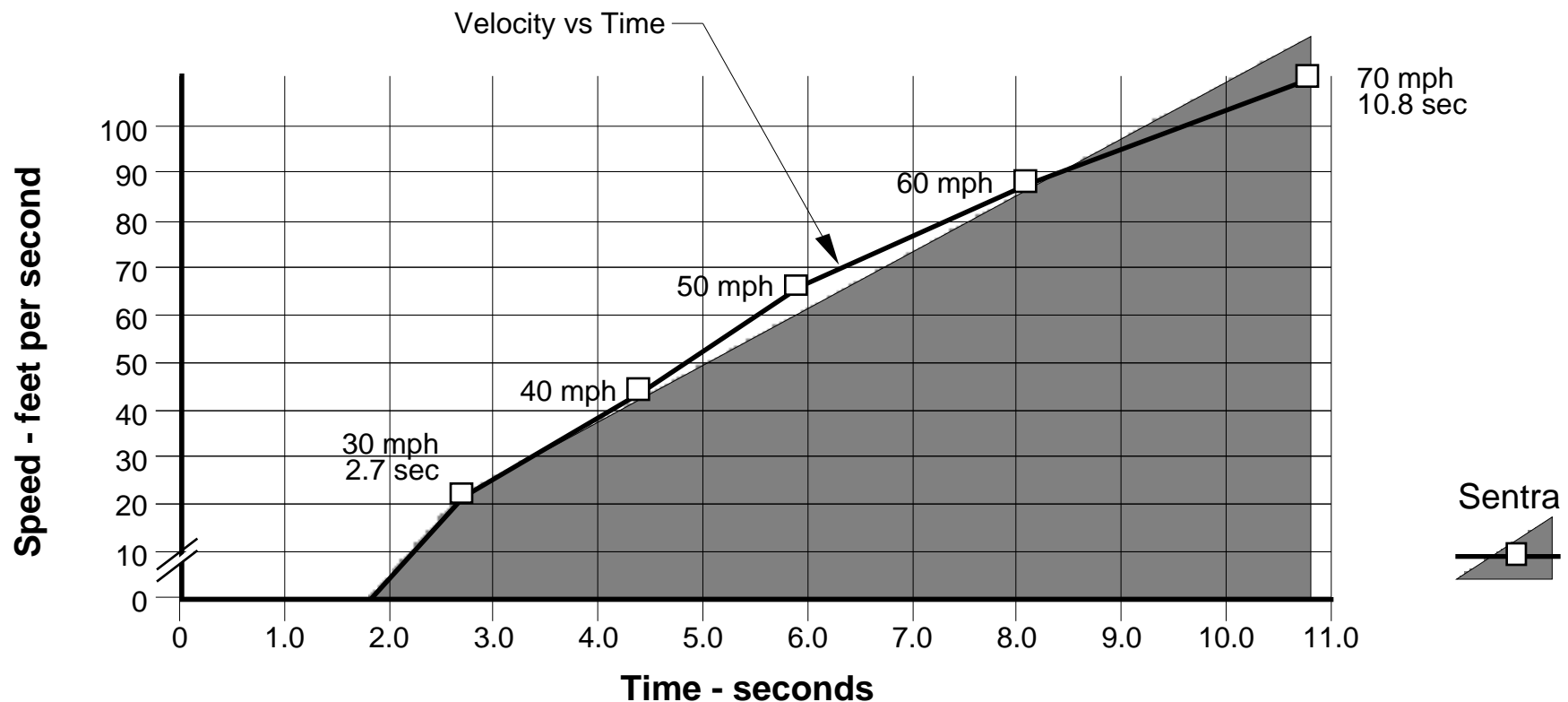
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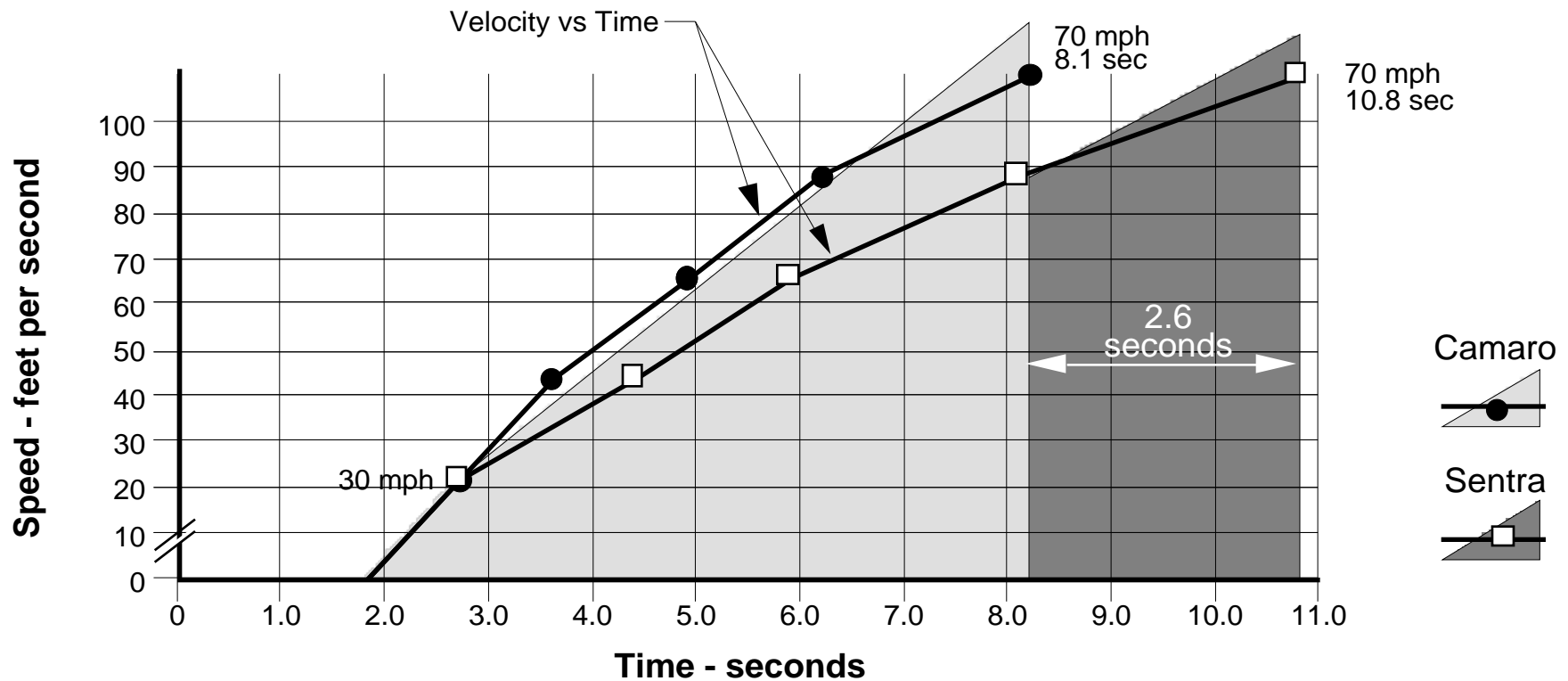
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Element Dimensions and Real Speed

Sentra Velocity vs. Time



**Under full acceleration from 30 to 70mph,
the Sentra will travel 627.75 feet in 8.1 seconds**

*Element Dimensions and Real Speed*Camaro and Sentra
Velocity vs. Time

The Sentra would have to travel 2.6 seconds longer and
201.5 feet farther than the Camaro to reach 70 mph

*Element Dimensions and Real Speed*

How a Straight Gives Time to Power

- How much effect can a big straight have on the competition?
 - Compare the transit times already known
 - Camaro:
 - 30 - 70 in 5.5 seconds; 426 feet
 - Sentra:
 - 30 - 70 in 8.1seconds; 628 feet
 - reaches 351 feet in 5.5 seconds
 - reaches 426 feet in 6.35 seconds
 - O.K. - so what does that mean?
 - The time advantage for the Camaro over a 426 foot straight section is about 0.85 seconds, or a total distance of 75 feet
 - How could the Sentra make up that difference?
 - The Sentra would need a higher entry speed into the straight away by 9.2 mph. This means it would need to pull about 71% more G's in the sweeper.
 - **Hey folks - That's 1.43 G's...**



Element Dimensions and Real Speed

Why do we care?

- How a straight gives time to power
 - O.K. - The Camaro (F Stock) is not classed with the Sentra (D Stock) but classes in Solo II do contain mixtures of cars! For example:
 - D Street Prepared:
 - Fiat X1/9
 - 1,935 pounds / 105 horsepower = 18.33 lbs/hp
 - Mazda Rx-3
 - 2,040 pounds / 170 horsepower = 12.00 lbs/hp
 - That is a 52.75% difference between cars in the same class
 - So what does that have to do with a Camaro/Sentra comparison?
 - Sentra
 - 2,600 pounds / 140 horsepower = 18.60 lbs/hp
 - Camaro
 - 3373 pounds / 275 horsepower = 12.30 lbs/hp
 - That is a 51% difference between the cars in our example
 - The horsepower to weight ratio disparity is approximately the same as the Fiat and the Mazda in DSP.



Agenda

- Fundamentals
- 10 Basic Concepts
- So you have a blank piece of paper...
- Elements, dimensions and real speed



- **Summary**



Summary

- If you have made it this far without falling asleep or giving up, you are to be congratulated - or at least, you qualify as a course designing data hound...
- Seriously, there is enough information here that you cannot possibly digest it all in one read through. I encourage you to keep this booklet and refer to it when designing Solo II type courses.
- I'd like to reiterate that this is a compilation of the experiences of Karen Babb, Gregg Lee, Jim Garry, Team.Net and myself, Roger H. Johnson. I would like to thank the others for their ideas in the creation of this booklet. Hopefully I have not let my personal opinions overshadow any "truths".
- Remember, the more courses you design and set up, the better your courses will be

*Please feel free to contact me with any
questions you may have.
I can be reached as listed below:*

Home of the Criminally Insane
Attention: Roger H. Johnson
Houston Region Course Designing Fool
1210 Sunset Drive
Friendswood, Texas 77546
(713) 244-7649 - work
(713) 992-7504 - home
rhj7649@ssf1.jsc.nasa.gov